UNESCO the Courier

PLANET
WAR'S CHAIN REACTION

PEOPLE AND PLACES
THE SOUL OF OLD CAIRO

INTERVIEW
OCIMAR VERSOLATO: HYBRID CREATIONS

UNESCO the Courier

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Biodiversity: a friend for life

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Biodiversity: a friend for life

Biodiversity is the essence of life. Without nature's tremendous variety, our planet would be hostile to human life. Our existence and well-being on Earth depend upon learning how to preserve this diversity.

To do so, we must strike a new balance with nature and commit to sharing its precious resources more fairly between the haves and the have-nots.

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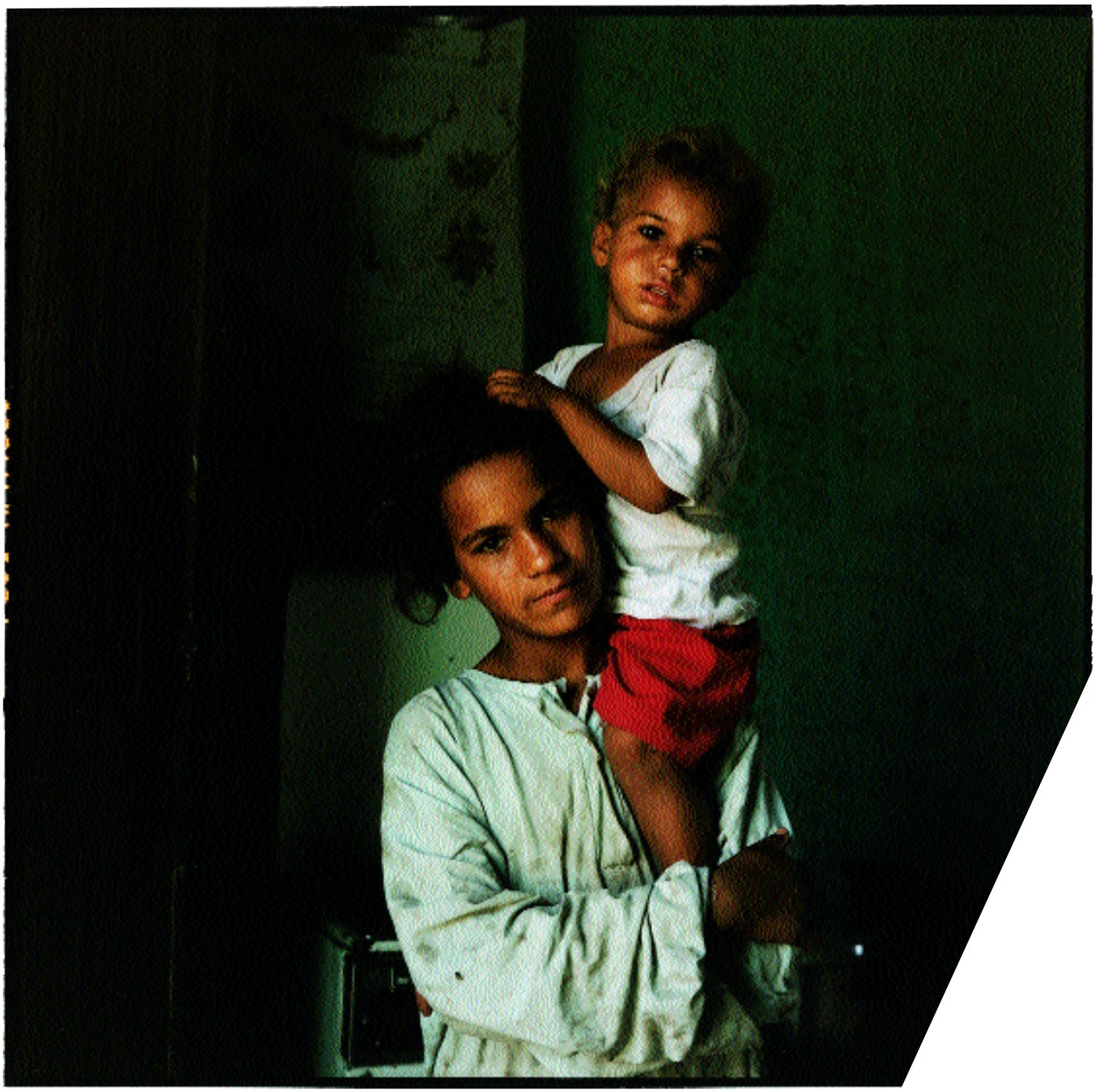
THE SOUL OF OLD CAIRO

Photos by Denis Dailleux; Text by Samir Gharib

A traveller weaves his way through streets and alleys crowded with memories

French photographer Denis Dailleux has been a member of the Vu agency since 1995. This year he won a World Press Photo award in Amsterdam (Netherlands). Samir Gharib, Egyptian writer and journalist, was appointed chairman of his country's National Library and Archives in 1999. His published works include *The Vitality of Egypt* and *Engravings on Time* (Egyptian Book Organization, 1996 and 1997).

I I was a child when I first discovered Cairo, one morning when I had travelled from my native Upper Egypt on the famous midnight train. I stayed with my aunt on my father's side, who lived in the Fostat quarter [name of a city founded in 641 by the Muslim conqueror Aman 'bn Al 'Ass] on the outskirts of Old Cairo. The air was filled with ▶



© Denis Dailleux/Vu, Paris

Photos © Denis Dailleux/Nu, Paris

► an acrid, penetrating smell from a nearby tannery.

On the first evening, I went to the nearest mosque, dedicated to the memory of an extremely pious man named Sidi Abdul Saoud. From an adjoining house came the sound of women's voices, cries, and beating tambourines, merging into a kind of incantation. I could not resist. Trying not to be noticed, I slipped into the courtyard of the house.

A group of common women, clad in long black dresses, were dancing in a circle, keeping pace with an increasingly quick, breathless beat. Their bodies merging into a single whole, their hips rocked by a movement they could no longer control, projected an irresistible sensuality.

A young man with hair as long as the women's and wearing a tight gown was standing in the middle of the circle and beating the rhythm with small cymbals. Some of the women dancing around him were playing tambourines.

It was a *zar* ceremony—a ritual held to remove a spell. The women had gone into a collective trance to expel from their bodies the demons that had possessed them. It had become so intense that some had collapsed and lay prostrate on the ground. The young man leaned over each one and whispered mysterious words into their ears and revived them.

I shall never forget that scene. It unexpectedly introduced me, as if I were a tres-

passer, into the very heart of Old Cairo.

If you take the road that today leads from Fostat to the international airport, you come to the foot of the great plateau and the overlooking Citadel built by Saladin in 1176. The impregnable silhouette of this symbol of power abutting the Moqattan hills rises above the capital and keeps watch over it day and night. When Bonaparte entered Cairo in the last days of the 18th century, it was here that he installed his artillery. It was from here that he shelled the rebellious poor neighbourhoods.

Before the time of the illustrious French general, the Citadel was the place where the Turkish governors representing the Sublime Porte were inducted in great splendour. It was here too that Mohammed Ali, seeking to take the reins of power in the early 19th century, invited all the Mameluke lords to his son's wedding—and then had them slaughtered to the last man.

One of the Citadel's gates leads to the

I never tire of weaving my way with friends at night through the latticework of streets and alleyways in this neighbourhood where the soul of Cairo never sleeps. Anything can happen on Al Batiniya Street.

Fatimid city, in other words the original Cairo, Al Qahira, founded by Gohar the Sicilian, who commanded the troops of the dynasty that conquered Egypt in 975.

The jewels of the Muslim city can be found there: Al Azhar University and the Al Hussein mosque, surrounded by dozens of other mosques that are lit up and come alive at night, calling to one another with the ebbing and flowing of the vast Cairo crowd. During Ramadan, the month of fasting and of feasting together, circles of believers chant praises to their Creator in harmony. And mystic brotherhoods from all over Egypt meet to sing and dance their love of God until dawn.

I never tire of weaving my way with friends at night through the latticework of streets and alleyways in this neighbourhood where the soul of Cairo never sleeps.

Anything can happen on Al Batiniya Street. The first time I innocently turned down this street, at nightfall, a man came up to me and asked if I wanted some oil. I ▶

Photos © Deris Dailleux/Lu, Paris

► politely turned him down. "It is top quality," he insisted. Why on earth should I want to buy oil I didn't need in the middle of the street? But I was intrigued by the gaze of that man who, while talking about oil, seemed to have something else in mind. When at last I figured out that he was talking about hashish, I ran away as fast as my legs could carry me. But that did not keep me from noticing other young people seated behind little tables offering passersby the same sort of oil.

All that happened a long time ago.

This first visit to Cairo was followed by many others. For a long time, I dreamed of living in the Al Ghourieh quarter. The severed head of Touman Bey, Egypt's last Mameluke sultan, was hung over the gate to this neighbourhood after the Ottoman Turks killed him in the 16th century. A year earlier his father, Sultan Al Ghouri, had been killed resisting the new conquerors. The quarter has borne his name to honour him ever since.

Al Ghourieh's elusive charm lies, I think, in the omnipresence of the past. The weight of history can be felt in each narrow street and, even more so, in the faces of the people who live there, which express, often unconsciously, the tranquil certainty that this has always been and always will be their home.

I really discovered this neighbourhood when I visited three artists who in the 1970s represented the creative genius of Egypt's

common people: the blind composer Sheik Imam, the poet Ahmad Fuad Negm and the lute-player Muhammed Ali. In their public performances, these three men dared to voice the anger of the poor, the outrage of students and the dreams of a better life that were embodied in those days by Ho Chi Minh and Che Guevara.

They lived in a shack that seemed in a state of imminent collapse. You had to be very careful where you put your feet. You might be invited to have a cup of tea, but certainly not a dish of grilled chops. Instead you had to settle for the smell that wafted in from a nearby stall.

Such a neighbourhood can hold a strange attraction. Something in the close-knit fabric of the buildings, in the vibrations of the passing crowd, excites the imagination. You can almost guess what the interiors of the houses look like, enter the alcoves, share amorous embraces, follow the silent gaze of women behind the *musharabiehs*.[1]

Fortunately, the women now go out into the street, often draped in wide black veils that are supposed to conceal their bodies from intrusive eyes but actually emphasize their shapely curves. There is a language in the undulations of the female body that I never tire of learning.

Al Ghourieh leads into a street named after Al Hakim Bi Amr Illah ("He who governs by divine decree"), the illustrious Fatimid caliph whose mystic personality has always baffled historians. In this street you can enjoy all the scents of the East, from perfumes to medicinal plants. Here traditional remedies for most known physical and psy- ▶

1. In Arab architecture, balconies closed by lattice-work allowing one to see without being seen.

© Denis Dailleux/Vu, Paris

chological ailments can still be found.

This street crosses another world-famous thoroughfare, Khan Al Khalili Street, where tourist coaches pour forth their passengers all year round. Here, Egypt's most skilful craftsmen display a dazzling array of hand-made products in gold, silk, glass, wood, copper and ivory. All kinds of things are for sale—even dresses for belly-dancers.

A visit to the celebrated Al Fichawi cafe, where they provide you with a royal hookah, is a must for anyone who wants to claim they really saw Old Cairo. This coffee-house is a microcosm of street life, an endless stream of newspaper vendors, shoe-shine men, beggars, street peddlers—as well as poets, novelists and journalists of every stripe.

Lastly, this neighbourhood was long the home of Egypt's national glory, our country's first Nobel Prize-winner for literature, Naguib Mahfouz. His best-known novels take place in this spellbinding maze of narrow streets and dead-ends, where the heart of the city beats and is haunted by his larger-than-life personages. From the immense fresco of characters in his novels, why am I tempted to recall only the *futuwa*? They were men who, with panache, masculine generosity and efficiency, enforced a certain order, even a certain justice, in their neighbourhoods. They formed a sort of people's police who stood up for the needy and the weak in the name of a chivalrous code of honour.

Today, they have disappeared. And with them, a whole world—that of Naguib Mahfouz himself—which gave Old Cairo its soul is disappearing from our lives.

As you will have guessed, I am unconsolable. ■

FROM VIET NAM TO RWANDA: WAR'S CHAIN REACTION

Fred Pearce

From destroyed vegetation to health hazards, the environment has been a systematic casualty of recent wars and pays the price long after peace returns

Concern about the environmental impact of warfare began in earnest with Operation Ranch Hand, the U.S. campaign to defoliate Viet Nam's jungles and flush out guerrillas during the late 1960s. American military aircraft sprayed some 70 million litres of extra-strong herbicides, mostly a formulation known as Agent Orange, over the country between 1962 and 1971, dousing 1.7 million hectares, often several times over. By the end of the war, a fifth of South Vietnam's forests had been chemically annihilated, and more than a third of its mangrove forests were dead. Some forests have since recovered, but much of the land has turned, apparently permanently, to scrubby grassland.

An unwarranted experiment in chemical warfare

From the start there was concern that Agent Orange was toxic to humans as well as trees. In 1964, the Federation of American Scientists condemned Operation Ranch Hand as an unwarranted experiment in chemical warfare. But the operation continued until a spate of reports in 1970 and 1971 that Agent Orange was causing birth defects. Soon research showed that 2,4,5-T, one of its two main constituents, caused malformations and stillbirths in mice and contained dioxin, a by-product that turned out to be one of the most poisonous substances known to science. It disrupts the body's hormonal, immune and reproductive systems, and causes fathers to produce damaged sperm.

Nature has cleansed Vietnamese soils and vegetation of most of the dioxin, but the chemical has lingered on in human blood, fat and breast milk. According to Le Cao Dai, director of the Agent Orange Victim Fund set up by the Viet Nam Red Cross, the breast milk of women in former South Vietnam who were exposed to Agent Orange in childhood contains about ten times more dioxin than that of women in former North Vietnam or industrialized nations such as the U.S.

Appalling birth defects among the children of veterans exposed during the war to Agent Orange and other pesticides are well documented. According to Professor Hoang Dinh Cau, the chairman of Viet Nam's 10-80 Committee, which investigates the consequences of the use of chemicals during the war, tens of thousands of children are affected. Common symptoms are limbs twisted in a characteristic way or missing altogether, and eyes without pupils. And now there is growing concern that a third generation of children may be affected.

Although less well documented, Iraqi attacks on civilian populations of Iraqi Kurdistan between April 1987 and August 1988 have had equally long-term effects. In the town of Halabja, bombed over three days in March 1988 with chemical and biological agents, about 5,000 to 7,000 people were immediately killed and tens of thousands injured. The first medical study of the attack's long-term effects was carried out by Dr Christine Gosden, a professor of medical genetics at the University of Liverpool. In a report to the UN Institute for Disarmament Research, she detailed serious medical problems, including rare cancers, congenital malformations in children, infertility, miscarriages, recurrent lung infections and severe neuropsychiatric disorders. She noted that delayed effects such as the development of cancers following exposure may occur five to ten years later.

All wars produce environmental damage. Some is deliberate and for direct military objectives. Clearly that category includes the defoliation of Indochina—as well as the accompanying physical clearance of some 300,000 hectares of forest using heavy tractors. Other ▶

One of the many Vietnamese children affected by their parents' exposure to Agent Orange.

© Hollymay/Camma Liaison, Paris

Freelance environmental writer and consultant for *The New Scientist*

© Jean-Michel Turpin/Gamma, Paris

Rwandan refugees in ex-Zaire have deforested areas in their search for food and firewood.

destruction is equally deliberate, but has a less clearly military objective, such as Saddam Hussein's sabotaging of Kuwaiti oil wells at the height of the Gulf War in 1991. His forces attacked some 730 wells, setting some 630 alight. Many continued to discharge oil into the desert and thick black smoke into the air for many months. The total release of oil was finally estimated at 10 million cubic metres. Some 300 oil lakes at one point covered 50 square kilometres of desert.

After Saddam threatened to set fire to the wells, some scientists warned that the black smoke could rise high enough into the upper atmosphere to upset global climate systems such as the Asian monsoon. These fears proved unfounded. But the local fallout of soot, carcinogenic particles and acidic sulphur dioxide spread for hundreds of kilometres around the Gulf. Kuwait City experienced "darkness at noon" comparable to the worst London smogs of the early 20th century, causing a rush of respiratory illnesses. It took six months and $10 billion to stop the fires and repair the damage to the wells. Some of the thick black oil remains in hollows in the desert.

The war damaged the desert in other ways. Gravel beds that once held the desert sands in check were fractured by thousands of bunkers, weapon pits and trenches. And the tracks of tanks and trucks compacted fragile soils and killed vegetation. The Kuwaiti Institute for Scientific Research concluded that more than 900 square kilometres of desert were damaged by military vehicles and earth movement. The result has been more erosion, sand storms, advancing sand dunes and diminution of plant life. The war released one million cubic metres of oil (out of the total 10) into the Persian Gulf, partly from Saddam's sabotages but much of it from the bombing of strategic installations by the U.S. and others. It severely contaminated some 400 kilometres of Kuwaiti and Saudi coastline with tar, and destroyed shrimp fisheries. Studies five years after the event revealed that Saudi coastal ecosystems had largely recovered, though turtle populations nesting on islands in the Gulf had not returned to their former levels.

But much environmental damage in war is unintended "collateral damage". The detritus of munitions such as cluster bombs and land mines are a major long-term threat to environments. The U.S. dropped some 1.5 million cluster bombs during the Indochina War, containing an estimated 750 million bomblets, according to Arthur Westing, a leading historian on the environmental consequences of war. It dropped a further 60,000, containing some 30 million bomblets during the Gulf War. They were left scattered across the desert along with some 1.7 million mines planted by the Iraqis. Most were cleared up afterwards. But this caused further damage to desert ecosystems as bomb disposal units ploughed up large areas of the desert.

Worldwide it is estimated that there are some 65 million functional land mines strewn around the countryside posing a threat to inhabitants and wildlife in 56 countries from Angola to Nicaragua, Eritrea to Laos.

Worldwide it is estimated that there are some 65 million functional land mines strewn around the countryside posing a threat to inhabitants and wildlife in 56 countries from Angola to Nicaragua, Eritrea to Laos. Anything bigger than a rabbit is likely to set them off. According to the International Committee of the Red Cross, they kill around 800 people and maim thousands more each month. It estimates that Cambodia has 36,000 amputees as a result, and Somalia 23,000. One of the more gruesome and unexpected consequences of the massive flooding in southern Mozambique in February this year was to float land mines left over after the country's long civil war from known minefields into villages and fields.

Refugees and deforestation

A new concern is the long-term consequences of the use of depleted uranium (DU)—a mildly radioactive and very dense material that weapon makers now put on the tips of munitions to penetrate tank armour. About 300 tonnes of DU was dispersed across the battlefield during the Gulf War. The environmental and human health impacts of the radioactive material left behind by these munitions remain unclear. There have been frequent claims that DU has raised cancer rates in southern Iraq and caused Iraqi soldiers exposed to it to father severely deformed babies. But so far no studies have confirmed this link.

The social dislocation caused by war is a further cause of environmental damage. Floods of refugees in particular can threaten natural resources such as water and forests. The Rwandan conflict and the events that it triggered in the Democratic Republic of the Congo (DRC, ex-Zaire) became a major cause of deforestation in central Africa. One casualty was Africa's first national park, the Virunga National Park, on the border between the DRC and Rwanda. The World Conservation Union (IUCN) reported that in six months, the Rwandan refugees and Hutu soldiers from camps around the town of Goma in the DRC had deforested some 300 square kilometres of Virunga National Park in their search for food and wood. At the height of the crisis, the IUCN estimated that some 850,000 refugees were living within or close to the park and took between 410 and 770 tonnes of forest products out of the park daily. In the confusion, Zairian soldiers were raiding the park for timber to sell to refugees and relief organizations.

Similar destruction became a feature of civil and cross-border conflicts across much of Africa in the 1990s. In March this year, the UN Environment Programme reported on the "transformation of natural land and forest areas" with "severe impacts on biodiversity and water systems" in southern

Guinea, following the influx of some 600,000 refugees from recent conflicts in neighbouring Sierra Leone and Liberia. Most of the refugees had hacked out forest to grow crops for food.

Guerrilla armies do as much damage as refugees, particularly when they have to live off the land or generate income to buy arms from the plundering of natural resources in the region where they are fighting. Armies also have to eat, and for guerrilla armies "bush-meat" is a frequent source of food. Guerrilla wars in Cambodia and west and central Africa have been sustained during the past decade through the cutting and sale of valuable hardwood timbers. Wildlife suffers too. In the Horn of Africa in the 1980s, Somali war bands were frequently behind the rampant poaching of elephants for their ivory. War in Uganda in 1979 killed off much of the country's bush elephant population, and conflicts in Angola and Mozambique have since caused the wholesale slaughter of elephants in those countries too. The Rwanda conflict and succeeding guerrilla activity in the surrounding regions through the 1990s saw the slaughter of mountain gorillas in Virunga and elsewhere—a fact that understandably gained little attention beside the massive slaughter of humans.

Silence on Chechnya

War and the environment have, of course, always been linked. Some of the earliest battles between city states in Mesopotamia 5,000 years ago involved the breaking of dykes to flood farmland. But the Indochina War was the first time scientists seriously probed the effect of a major conflict. The Gulf War was perhaps the first time those consequences were seriously addressed before they happened, with experts (erroneously) forecasting a global climate change if fire was set to the oil wells. During the Kosovo conflict, the environmental consequences of the bombing of factories gained precedence in much reporting over the intended economic damage. There can be little doubt that the environmental impacts of Russian military activity in Chechnya and Afghanistan has been as severe as that of the U.S. and its allies in southeast Asia, the Gulf and elsewhere. But far less is known as independent investigations have been notable only by their absence. In Chechnya, the severity of the military battles and the physical destruction of Grozny has been so great that likely environmental damage such as pollution of water supplies, though of undoubtedly long-term importance for rebuilding, has to date barely been remarked upon. The continuing conflicts in Afghanistan have made independent assessment of the impacts of 20 years of war there hard to pursue. ■

THE POLLUTION OF THE BALKANS

◗ Nevena Popovska and Jasmina Sopova

Air, soil and water were severely polluted by NATO's bombing of Yugoslavia last spring, raising fears of long-term effects on health

The Pancevo oil refinery near Belgrade burning after NATO bombings in April 1999.

© AP/Boomerangs/Srdjan Ilic

The Atlantic Alliance officially recognized on March 21, 2000 that it used depleted uranium ammunition in shells in Yugoslavia during the previous year's war. Kosovo and southern Serbia bore the brunt of these radioactive weapons, used for the first time during the Gulf War in 1991. They release clouds of uranium dust that contaminate water and the food chain. Particles enter the human body through inhalation or ingestion, remaining there from one to three years, increasing the risk of sterility, birth defects and cancer tenfold.

From March 24 to June 10, 1999, NATO warplanes flying close to 31,000 sorties bombed the entire Yugoslav Federation (Serbia, Montenegro, Voivodina, Kosovo). Thousands of missiles were fired, some of which landed in neighbouring Bulgaria and Macedonia. ▶

◗ Respectively journalists in Skopje (Republic of Macedonia) and with the *UNESCO Courier*

Furthermore, many pilots flying back to their bases dropped bombs into the Adriatic Sea off the Croat, Slovene and Italian coasts. According to NATO sources, 1,600 cluster bombs, which are banned by the Geneva Convention of 10 October 1980, were dropped, releasing 200,000 bomblets. Thousands have not yet exploded, becoming as dangerous as antipersonnel mines. They have already killed nearly 200 Kosovars.

A year after the strikes,the real scale of the environmental damage has not been clearly established.According to the joint UN Balkans Task Force (BTF)[1], pollution has severely affected four areas: Pancevo (20 km from Belgrade), Novi Sad (the capital of Voivodina),Kragujevac (southern Serbia) and Bor (near the border with Bulgaria).

The Pancevo petrochemical complex was bombed approximately ten times. A press release by the mayor, Srdjan Mirkovic, published in autumn 1999 in the Yugoslav review *Petroleum Technology Quarterly*, announced that the "direct strike on the depot containing 1,500 tonnes of vinyl chloride monomer (VCM) caused a fire that burned eight hours and destroyed approximately 800 tonnes" of that carcinogenic substance. "When it burns," says a Belgrade doctor, "it gives off, among other things, chlorhydric acid, which causes chronic bronchitis, dermatitis and gastritis; as well as dioxin, regarded as the world's most toxic organic pollutant; and possibly phosgene, which was once used in chemical warfare."

1. *The Kosovo Conflict.Consequences for the Environment and Human Settlements*, UNEP-UNCHS, 1999.

Mercury enters the food chain

Ammonia depots used to make fertilizer were also bombed. Had they not been emptied beforehand as a precaution, their explosion would have killed any person within a 10-kilometre radius, as direct exposure to ammonia is lethal to humans. The worst was avoided, but the ammonia was released into the Danube, where wildlife was killed 30 kilometres downstream. In addition, "over 1,000 tons of ethylene dichloride and a few thousand tonnes of natrium hydroxide" were leaked into the Danube, according to a report by the Regional Environment Centre for Central and Eastern Europe (REC). Since then, fishing has been abandoned and crop irrigation has become problematic. The river's sandy bed has trapped heavy metals, which are toxic even in small concentrations, for dozens of years. In addition to Yugoslavia, Romania and Bulgaria are affected.

"The soil has been contaminated by approximately 100 tonnes of mercury," says Pancevo's mayor. Mercury is an extremely toxic metal that enters the food chain and builds up in the human body, causing irreversible organ damage. The BTF however found that eight tonnes of the substance had leaked from the petrochemical plant and reported that "the air strikes on the oil refinery caused an estimated 80,000 tonnes of oil and oil products to burn. This would have released noxious substances into the air." According to Belgrade's Public Health Institute, VCM concentrations in the air were 10,600 times above the tolerated norm near the Pancevo petrochemical plant. At the time, the wind was blowing from the west, sending the harmful fumes into Romania and Hungary as well.

Black spring and acid rain

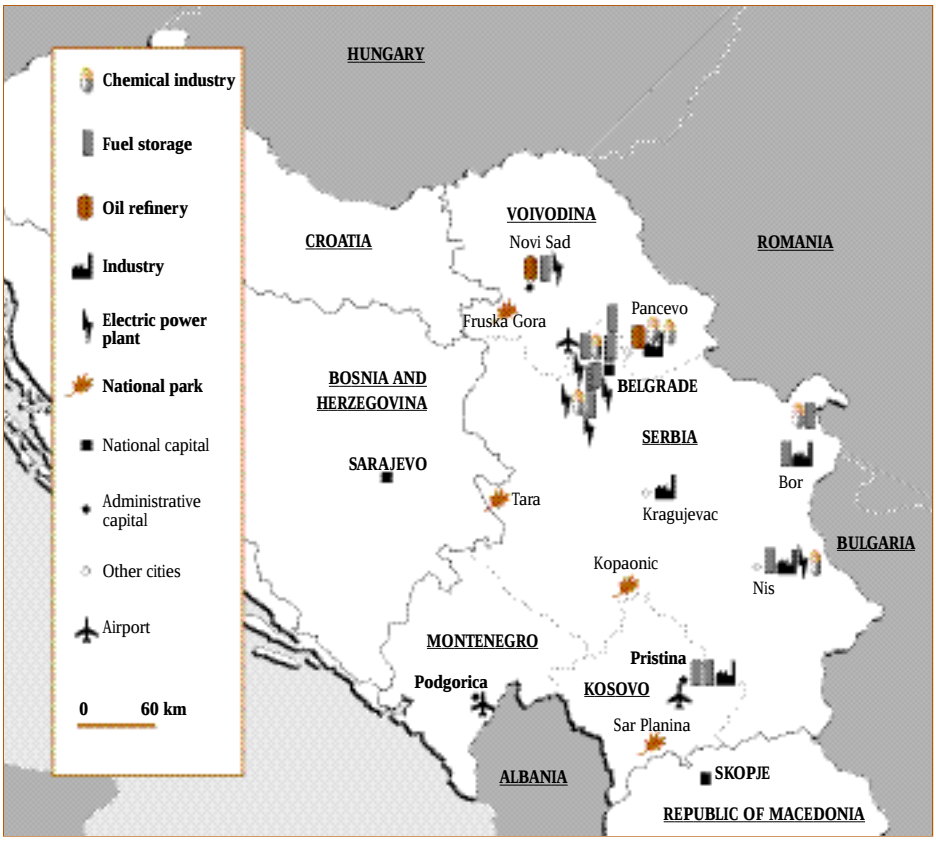
The other three "ecological hotspots" suffered a similar fate. The Novi Sad oil refinery was bombed a dozen times between June 5 and 9.Approximately 73,000 tonnes of crude oil and derivative products burned or leaked into pipes. Polluted underground water seeped into wells near the refinery, depriving the local population of drinking water.

The strikes against the Zastava automobile factory in Kragujevac "reportedly caused extensive environmental pollution, with damage to soil, water and air," reports the BTF, which detected high levels of polychlorinated biphenyls (PCBs).Banned in the mid-1980s because they are so toxic, these substances can still be found in old electrical facilities. Very persistent, they bind with sediments in rivers and streams and degrade only after many years.

PCB contamination and severe air pollution caused by emissions of sulphur dioxide gas (which is especially hazardous for asthmatics) were reported in Bor. Bombings of copper mines, the power plant and the hydrocarbon fuel depot near Bor also affected nearby Bulgaria. The Sofia newspaper *24 Hours* reported that birds fell dead out of the sky and the cloud spread, causing acid rain. At the same time, farmers in Kosovo witnessed trees losing their leaves in the middle of spring.

The entire food chain was affected, from livestock fodder—and, consequently, meat and milk—to fruits and vegetables intended for consumers. Chronic bronchitis, asthma, eczema, diarrhoea and thyroid disorders have already been detected, but Serbia's officials would rather cover up the facts. What seems clear is that the most serious health problems are yet to come.■

Targeted sites with potential negative environmental impacts.



Source: UNEP/GRID-Geneva BTF

SCIENCE TEACHING'S QUANTUM LEAP

Asbel López

Teachers must prepare not only future scientists, but also citizens who will confront unprecedented technological and ethical challenges in their lifetime

When Mexican teacher Jose Antonio Lopez Tercero was a student, he regarded as quite plausible the idea that velocity and potential energy are like two machines that can be stored in a cupboard. Back in those days, he was led to believe all kinds of outlandish things. His innocence was caused not by reading Gabriel Garcia Marquez's magic realist novels, but by dozing through abstract physics classes. "They were awful," recalls Lopez Tercero, who now teaches chemistry at the Escuela del Sur Institute, a secondary school in Mexico City.

Today he tries to teach science in the way he would liked to have learnt it. As often as possible, he uses everyday objects to help his students grasp abstract concepts. A washing machine can illustrate dispersion by centrifugal force; clothes show how to distinguish natural and synthetic fibres; plastics aid the study of oil derivatives; lemon juice and red cabbage bring acids to life, while television helps explain how electromagnetic waves work.

This approach represents a huge qualitative change, at least in comparison to what Lopez Tercero had to go through as a pupil. Back at secondary school, he remembers that "the teacher would arrive, announce a concept, write down a formula, and teach us how to solve problems using the latter. All I did was work through the formulas by replacing letters with numbers."

This traditional teaching method, based on the transmission of a body of knowledge and the study of problems with little relevance to many students, is still practiced, and not just in Mexico. According to Jacob Bregman, a specialist in science education at the World Bank, "science education in developing countries often relies too much on memorization of facts and not enough on learning to understand the relevance of knowledge and its application in the local context." In the industrialized countries there is much greater emphasis on the problem-solving approach, decision-making, and developing the ability to analyze and work in a team.

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Hands-on learning: in Namibia, students test the resistance of mudbricks.

Failings in the educational systems of Third World countries are particularly alarming because economic development is increasingly linked to scientific and technological knowledge. But there is now a widespread desire for change, reflected in a wave of reforms in scientific education that have taken place around the world in the last few years.[1] And though the reforms differ from country to country, they have certain common features.

One of them is relating science to everyday life, as Lopez Tercero does in Mexico. As well as improving the learning process, this method makes students more enthusiastic and genuinely interested in science. In recent years, half of the graduates from the Escuela del Sur Institute have embarked on scientific careers, 30 per cent more than the Mexican school average.

Unearthing the practical end of knowledge

Relating science to everyday life also means anchoring teaching more firmly in the local context. Using problems that affect the community, teachers endeavour to show the practical value of scientific knowledge in determining the causes of specific phenomena. They encourage students to come up with ways of possibly ▶

UNESCO Courier journalist

1. Sylvia A. Ware (editor): *Science and Environment Education, Views from Developing Countries*, The World Bank, Washington D.C., 1999.

Paul Black and Myron Atkin (editors): *Changing the Subject*, London: Routledge with the Organization for Economic Co-operation and Development (OECD), 1996.

preventing environmental catastrophes.

Teachers are making "huge efforts in their classes to treat problems which are relevant to the students instead of using abstract examples from textbooks," says Bettina Walther, the co-ordinator of a science education project in Tanzania's secondary schools. Launched in 1997,the project involves maths teachers from 27 schools, who focus lessons on development projects in the towns where they teach. For example, geometry courses might be based on the practical case of installing electricity and telephone lines to explain concepts while applied maths lessons look to using fertilizers and pesticides for learning various operations.

Even while looking at the stars, these teachers base their classes on widely held local beliefs. Peter Lesala, a science education adviser to Lesotho's secondary schools, is writing a course on astronomy that will feature in his country's curriculum. "The first thing I did," he explains, "was to do some research into Basotho beliefs about the stars. My course will start with a discussion of those beliefs."

Some science education projects might be inspired by a foreign model. In this case, the key lies in adapting themes to local conditions, as some teachers and students have done in a highly creative way using "ChemCom: Chemistry in the community", a secondary school course drawn up by the Washington-based American Chemical Society, an organization dedicated to advancing knowledge and research in the field of chemistry and related sciences (see box).

Science for all

Underlying this reform trend is the conviction that far more young people should have access to scientific education. Sylvia Ware, author of several reports on science education in developing countries for the World Bank and director of Education and International Activities at the American Chemical Society believes in science for all, not just for future scientists. "Those involved in reforming science education believe that science is too important to be left up to scientists alone. The general public must have a much broader and more subtle understanding of science than they have at the moment. Problems of developing countries such as water supply, health, industrial development or land use have to be addressed by people who understand the science and technology involved."

In other words, the goal is to provide basic scientific literacy so that citizens can take an active part in crucial debates on issues ranging from environmental pro-

AN EXPERIMENT ON DENSITY

Lemon, water, salt and a glass are all that Mexican secondary school teachers need to prove that bodies float in denser liquids. A lemon is denser than water, for instance, which means that it sinks to the bottom if put in a glass of water. By adding salt, the density of the solution gradually increases until it is greater than that of the lemon, which thus rises to the surface.
(*El Libro para el maestro. Quimica*. "Teacher's chemistry manual", Educacion secundaria, Public Education Secretariat, Mexico, page 64, 1994).

During an in-service training workshop in the Philippines, teachers build a bridge model using local materials.

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tection, to the use of genetically modified organisms, to the new ethical dilemmas posed by modern biological discoveries.

Through activities like sorting garbage, protecting certain endangered animal and plant species and conserving water resources, science education can help train citizens to be aware of their social responsibilities. One example is the Globo project in Costa Rica, whose goal is to make students aware of environmental protection by studying the El Niño climatic phenomenon. Young Costa Ricans measure temperatures and record rainfall levels in their communities. This data, gathered by relatively complex instruments, is then used in maths courses to draw graphs, in the social sciences to study the impact of floods on communities and in biology classes to explain life cycles.

Ware says the issue of "science for all" has been debated "from Argentina to Zimbabwe". The big question is how to make scientific knowledge more accessible to more students without lowering standards in courses for those who will become the scientists of tomorrow. The answer is complex, requiring a system that is flexible enough to offer more precise and in-depth knowledge to those planning to follow a scientific career, while at the same time giving everybody else scientific training that allows them to function in society.

Through activities like sorting garbage, protecting certain endangered animal and plant species and conserving water resources, science education can help train citizens to be aware of their social responsibilities.

Although developing countries are far from having solved this issue, nations like Argentina, Brazil and Chile have chosen the route of specialization. In Chile, students in the first years of secondary school follow the same programme. The aim is to give them a grounding for becoming well-rounded, socially responsible citizens. In the last two years, a streamed system offers two specializations: a technical and professional kind, aimed at training future employees able to compete in the world market; and a more theoretical scientific course that stimulates analytical thought and strives to instil higher levels of conceptual understanding. This stream is more specifically geared at students interested in pursuing a scientific career. Using this mix, the Chilean model aims to ensure the creation of a highly trained workforce that can respond to rapid changes in the labour market, while at the same time establishing a scientific community which can carry out the technological innovations needed to modernize the country's economy.

Investing in teachers

These sorts of innovations may well be major advances, but according to Ware "you can't just change the curriculum and expect things to change in the classroom. You have to work with teachers and help them become familiar with the new material and new ways of teaching." Unfortunately, teachers in developing countries are in a precarious position, and are thus unable to assume natural leadership in the reform process.

In Chile, teachers work between 33 and 44 hours a week in two or sometimes three different schools. In Mexico, students—numbering up to 60 per class—are generally taught by dentists or doctors retrained for the purpose, or by teachers with more knowledge of classroom technique than the subject they are supposed to be covering. Neither students nor teachers stray far from the textbook. "The main problem with science education in Mexico is no longer the issue of programmes or of textbooks; the weak point lies in teacher training, which is practically left up to fate," declares Vicente Talanquer, a chemistry professor at Mexico's Autonomous University. What he qualifies as a "big gap" still divides educational plans and study programmes from the abiding reality of the classroom.

In Ware's opinion, there is only one way to fill this gap: "invest as much as possible in teachers' professional development." While adapting the ChemCom course for use in Russia, the American Chemical Society, supported by UNESCO, has also offered training workshops for teachers, even for those from the most far-flung towns in Siberia. As a result, the teachers get to know the educational materials and methods, as well as new evaluation tools that enable them to find out whether a student has simply learnt concepts by rote, or if on the other hand he or she has understood the ideas and is able to apply them in different situations.

Enormous public investment and resolute political will are required to guarantee this training in the long term. Given that the reform of scientific education in Mexico began only seven years ago, and involves 200,000 secondary school teachers and 600,000 teachers in primary school, it is clear that the radical changes everyone is seeking will not happen overnight. ■

CHEMISTRY IN THE COMMUNITY

ChemCom is a chemistry curriculum written for secondary school students by the American Chemical Society (ACS) in 1980. It attempts to enhance science literacy by emphasizing chemistry's impact on society. Despite being the world leader in science and technology, the U.S. still records generally unsatisfactory levels of scientific education—a fact which has worried government, teachers and parents alike. Since the late 1990s, the programme has been used in schools in many other countries, from the suburbs of Buenos Aires to towns in Siberia. It has been translated into Japanese, Russian, Italian and Spanish, and a French version will shortly be completed.

One 14-year-old student from Krasnoyarskii Krai in Siberia describes ChemCom's methods as follows: "First, the teacher introduces a problem, for example the pollution of a river, then we students try to find out what kind of scientific knowledge is needed to solve the problem. But the most important thing is that we consider several possible approaches and discuss them before making a final decision."

The subject of one of the ChemCom course units, "Petroleum: To build? To burn?" is based on details from the U.S. context. But that was no obstacle to students from a rural Siberian school, the Bolshoi Ului, who made full use of the course for their own region—an oil-rich area like Texas. Two students went with their parents to gather information on local oil production from the Environmental Protection Committee in the nearest town, Achinsk. Not only did they get the facts they wanted, but the local media launched a campaign to collect and donate newspapers and magazines to the students for their project, which has since been titled: "Natural Resources in Bolshoi Ului: preserve them or use them?" ■

ChemCom's internet site is at http://lapeer.org/chemcom

Focus

Biodiversity: a friend for life

Since the time of Aristotle, we have been trying to inventory the world's plant and animal species. Yet in the year 2000, this colossal task is nowhere near being achieved. It probably never will be, despite the efforts of taxonomists and scientists prospecting for this "green gold" (pp.18-19).

Nature's riches are beyond measure and its mechanisms all the more difficult to grasp insofar as biodiversity is a broad concept, encompassing genes, species and ecosystems (pp.20-21). But scientists are clear about one fact: the unprecedented environmental damage caused by human activity is putting a record number of species at risk of extinction (pp. 22-23).

And yet, biodiversity is the very essence of life (pp. 17,24-25).Ecosystems provide a host of environmental services (pp.26-27) that make our planet habitable. Genetic diversity is key to assuring the world's food supply and provides a formidable gene pool for biotechnology, especially agriculture (pp. 27-29) and medicine (pp. 30-31). It also offers a boon for eco-tourism (pp. 31-32).

Yet it would be a grave mistake to think we can preserve biodiversity by trying to isolate it. People are an integral part of this dynamic system. Sustainable conservation demands support for a global network of nature reserves involving local people closely in their management (pp. 33-34). Seed and gene banks, like that of Kew Gardens in London (pp. 35-36), are also gaining ground. But managing the planet's "green gold" is also sparking legal and ethical battles beyond what anyone could have imagined in 1992, when the international community adopted the Rio Convention on Biological Diversity. ■

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Opinion

A necessary partnership with nature

Catherine Larrère

French philosopher and author of Les Philosophies de l'environnement ("Philosophies of the Environment"; PUF, Paris,1997) and Du bon usage de la nature ("Of the Good Use of Nature";Aubier, Paris, 1997)

The giant panda and the blue whale are symbols of a wildlife whose richness and diversity we want to preserve, for the protection of threatened species is one of the oldest ways of protecting nature itself.

But we now know that biological diversity, or biodiversity, is a concept that refers not only to species but to the entire living world, from genes to the biosphere, the regions of the earth's crust and atmosphere occupied by living organisms.

Biodiversity is not static. It can be defined as a constantly evolving system. Scientists say it allows living organisms to adapt to environments that change over time, thus ensuring the continuity of evolutionary processes.

Today, human activities are acknowledged to be part of this, but for a long time people were seen mainly as agents external to nature, ones that upset biodiversity. Efforts were made to preserve "virgin" or "wild" natural spaces by keeping them separate from all human activity.

The power to destroy and sustain

It is a fact that human beings are the source of clear threats to nature. Pollution, excessive harvesting of living species, the extermination of "harmful" species, and the fragmentation or destruction of habitats cause species to disappear and speed up the erosion of biodiversity. But since biodiversity has been conceived from a dynamic standpoint, humans have also come to be regarded as capable of sustaining biodiversity, as has been shown in France in the wooded pasturelands of Normandy and Brittany. Even tropical forests are often the fruit of a lengthy co-evolution between indigenous populations and their natural environment.

This power to both destroy and sustain biodiversity emphasizes the breadth of our responsibility. Human beings are just one species among others, but one that exercises a particularly demanding process of selection. No part of the planet can now escape human activity, so the idea of conserving nature as a whole is no longer tenable.

However, we have to weigh up the consequences of our actions on the evolutionary process so that we can regulate them. The principle of the "sustainable management" of biodiversity springs from this necessary partnership between human beings and nature.

But what are the yardsticks for such regulation? Perhaps the instrumental value of biodiversity—the goods and services it provides and the knowledge scientists draw from it. But since we enjoy nature's beauty, we have to add in the aesthetic or religious feelings it inspires.

The intrinsic value of nature

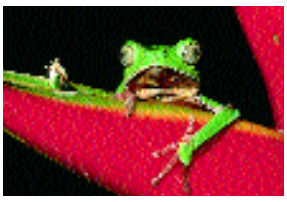
This leads us to the intrinsic or ethical value of biodiversity. Nature has its own worth, independently of how it can serve people. All living organisms, through their existence and their use of complex, non-mechanical strategies to survive and reproduce, have their own value. Beyond that, biological diversity itself, because it is the product of evolution and also the condition for its continuation, has its own intrinsic value, as the opening lines of the Convention on Biological Diversity (Rio, 1992) acknowledge.

The human bias behind the instrumentalist approach has often been set against the ecological bias underlying the intrinsic value approach, as if a choice had to be made, as if everyone had to die for the last wolf to be saved, or vice-versa. But apart from the fact that such options are entirely artificial, the two approaches can coexist, as soon as there is agreement about a dynamic and integrated view of biodiversity as an evolving system that includes people.

However, the rise of genetic engineering, which treats genes as raw material, has put biodiversity in quite a new light. It is now seen as an enormous pool of resources to be speedily tapped. As such, genetic biodiversity is no longer about the wise management of nature. It becomes a source of profit and of conflict among those seeking to control it. ■

Man is a rope stretched between the animal and the Superman – a rope over an abyss.

Friedrich Nietzsche, German philosopher (1844-1900)



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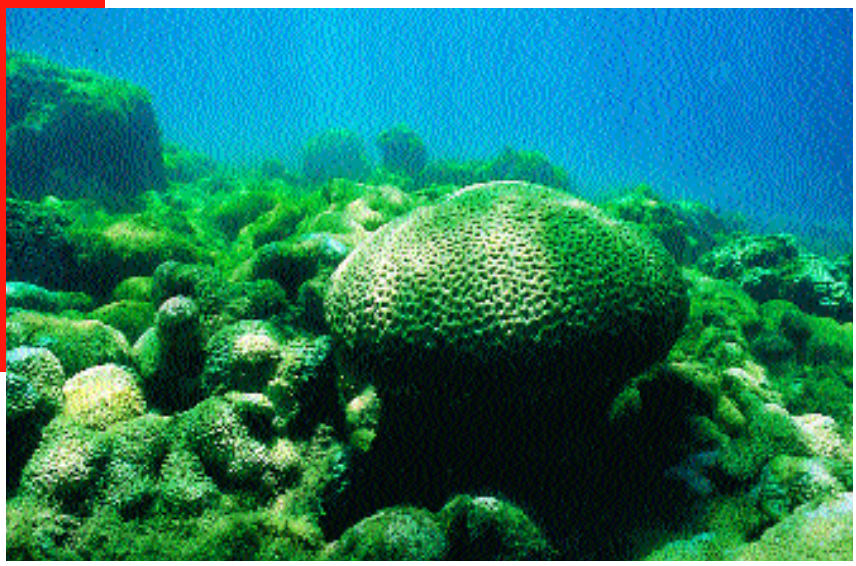
1 Nature under threat

The lair of the batfish

Timothy B. Werner

Dive into the turbid waters of Brazil's Abrolhos Bank to explore the mysteries of its marine biodiversity with a team of leading scientists



© Tim Werner/Conservation International, Washington D.C.

Mussimila braziliensis, a coral species found only in Brazil, produces unique mushroom-like formations known as chaperiões.

Day 1: Nova Viçosa

Aboard two fishing boats, we're chugging through the muddy waters of the Caravelas River to the first survey site at Nova Viçosa reef. Once out of the river's mouth, the blue water teems with coral reef animals that only live in this part of the world. On our first dive, I descend past a mat of anemone-like creatures commonly called "baba-de-boi", or bull's slobber. Brush up against this animal's mucus lining, and you instantly understand how it got its name. Below this mat, I am surrounded by a number of ancient and endemic corals that make this area such a priority for global conservation.

Over the next three weeks our team of leading marine scientists will log about three dives a day to document the bank's marine biodiversity.

Days 2-3: Popa Verde

Our Brazilian fish specialist, Rodrigo Moura, spies a lemon shark and what will be one of only two shark sightings for the whole survey. For the shark-wary this is good news, but to a marine conservationist it is worrisome. Sharks are important top predators in the ocean. Remove them and you can disturb the ecological balance. Around the world, they are increasingly rare from heavy demand particularly for their fins, meat and liver oil. Fortunately, on this same dive I see a huge grouper—longer than I am—which is a good sign. Large fish still thrive in the waters of Abrolhos.

Day 4: In the wake of Cabral

Exactly 500 years ago, the Portuguese mariner Alvares Cabral reported seeing lush tropical forest from the same spot where we are anchored. Our view is very different. Logging has destroyed all but about 8 per cent of this unique forest, prompting Conservation International to classify it as one of the world's top "hotspots" or priority areas for conservation (see p. 21).

Deforestation also takes its toll on the ecology of coastal waters. Erosion unleashes a steady stream of sediments that can "choke" or even bury corals. Most of the corals found on the Abrolhos Bank appear adapted to the turbid conditions that would kill species in other parts of the world. We find one of the endemic coral, *Scolymia wellsii*, in a pit five centimetres below the muddy sea floor!

Day 5: Corumbau

We are anchored directly across from the fishing village of Corumbau where local elders claim they once burned coral to produce house paint. Elsewhere along the Brazilian coast, there are houses built of coral boulders. These practices have been abandoned but corals and other living marine animals are still harvested illegally for sale in the curio trade. One of the most coveted is the Brazilian snail, *Strombus goliath*, which can reach lengths of 35 cm. During our entire survey we will see only one individual.

Day 8: Paredes

Today's destination is Brazil's largest coral reef, Paredes. At first, the reef looks barren but in crevices we find several interesting fishes and corals we haven't yet seen during the survey.

At the bottom of a steep wall I see one of the world's strangest looking marine fishes: a batfish. Dull green and shaped like a swollen arrow, the batfish not only swims but crawls along the sand like a reptile, using its fins as feet.

Director, Marine Biodiversity Program, Centre for Applied Biodiversity Science, Conservation International

Day 13: California Reef

After hours of searching, our boat's depth finder picks up California reef—between 20 and 35 metres down. But it turns out to be well worth the search. Wrapped in a luxurious growth of gorgonian corals, the reef's pinnacles produce new records of corals and fishes for the survey. What a surprise to find several colonies of the coral species *Porites branneri* with bright red tentacles—a sharp contrast from its usual drab brown-and-white colour.

Returning to our anchorage at Santa Barbara Island, we see boats fishing illegally well inside the boundary of the Abrolhos National Marine Park. The morning before we radioed in the name and identification number of one of these boats to the park guard. That afternoon, we heard a naval officer speaking by radio with the alleged offender, telling him that he shouldn't get overly concerned as it was only a "tourist" who provided the information.

© C. Alley/Conservation International, Washington D.C.

The Dusky damselfish (Stegastes fuscus) is one of the many species found only in Brazilian waters.

In the evening, we decide to check out the local nightlife. Much like a submerged city, a coral reef has towering structures of stone crawling with denizens, some of whom spring to life only when the sun sets.

Thousands of polychaete worms wriggle around our underwater lights in a reproductive frenzy known as swarming. On certain nights of the year, linked to the lunar cycle, polychaete worms release masses of sperm and eggs. If I keep my light on too long at a certain spot, I began to feel these worms scurrying inside my ear and brushing my face. We have just observed the first known spawning event to take place in Brazil in February.

Day 17: A look at the edge

We are as close as we will get to the edge of the continental shelf. This is an ideal location for observing "cleaning stations". At certain rocky outcrops, small fish await the arrival of the larger fish, much like a pit crew in a motorcar race. The large fish swim up and stop while the smaller fish begin picking off their parasites.

Day 18: Wrapping up

The whole team meets on deck to discuss our preliminary findings. It looks very likely that our field collections will reveal many new species, possibly including 20 polychaete worms and many records for this area, such as 20 new plant species and five new fishes. We have also discovered that a species of reef coral once thought rare in Brazil, *Stephanocoenia michelenii*, is actually common.

To our dismay, fish populations seem to be fewer in number than expected and many of the individual fish tend to be small. The closer we come to fishing communities, the worse the situation appears to be.

Several months of analysis remain before we release our final conclusions. The next step will be to put this information in the hands of conservation managers. Beyond the mud-choked waters of the Caravelas River lie essential areas of biodiversity. We cannot afford to lose them simply because we couldn't evaluate their extraordinary wealth. ■

Setting sail

For three weeks this past February, Brazilian marine scientists and international conservation experts teamed up to survey the Abrolhos Bank as part of the Rapid Assessment Program (RAP) set up by Conservation International, an NGO based in Washington. RAP has launched a total of 29 expeditions—exploring land, freshwater and marine environments—which have resulted in the discovery of hundreds of new species, improved biodiversity management by identifying priorities at the local and global levels, and led to the creation of six protected areas in five countries.

In contrast to the world's two great areas of coral reefs—in the Indo-Pacific and the Caribbean Sea—Brazil's coral reefs are not very rich in biodiversity, but they do harbour a large number of endemic species. The main focus of the Abrolhos survey was less on finding new species and more on helping local managers understand how different parts of the bank compare in terms of biodiversity and environmental threat. Many of the sites we selected for our survey had never before been scientifically inventoried.

The Abrolhos Bank is the single largest area of coral reefs in the southern Atlantic, covering about 8,000 km^2 off the southeastern corner of the Brazilian state of Bahia. As far as we know, there is no other place on earth where you can see a kind of coral reef pinnacle known as a chapeirão, which look like giant mutant mushrooms, overgrown with fans of fire coral and round knobs of endemic brain coral.

Months of preparation went into the expedition. Weather was a major concern because most of the bank consists of loose sediments which are easily stirred up by wave action and create underwater "dust" storms. Fortunately, we ended up with 18 days blessed by sunshine and light winds.

In the coming months, our science team will be analyzing the results to help us formulate a list of recommendations and priorities for conserving the marine biodiversity of the Abrolhos Bank. ■

http://www.conservation.org

Nature makes nothing in vain.

Aristotle,
Greek philosopher
(384-322 B.C.)

© Lynn/Jacana, Paris

Uncharted territory

Paradoxically, scientists know more about the stars in our galaxy than about the number of species living on Earth

Coined by American researchers in the mid-1980s, the term biodiversity has been in the media spotlight ever since. It is a highly complex concept which is still not widely understood by the general public. For scientists,the area of research it covers remains uncharted territory.

According to the Convention on Biological Diversity adopted in Rio de Janeiro (Brazil) in 1992, biodiversity is defined as "the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species and of ecosystems."

In plain English, biodiversity is both an idea and a physical reality. As an idea, it refers to the "variability" of living organisms, namely to their ability to evolve in space and time, to adapt and to survive.But it is also a physical reality, comprising all living organisms and the relationships between them. The concept of biodiversity can be broken down into three different levels: genes, species* and ecosystems*.

Surprising as it may seem, scientists know more about the number of stars in our galaxy than they do about the number of species living on Earth. Taxonomists* have inventoried approximately 1.7 million living organisms—plants, animals and micro-organisms (bacteria, viruses, fungi, etc.). But a host of others exist in nature and it's anybody's guess exactly how many. The most common estimates vary between eight and 15 million, but some range up to 100 million. It would appear that the environments with the highest number of endemic* species are humid tropical forests.

2,000 apple varieties identified worldwide

With the exception of mammals, the higher plants and birds, scientists are rather unfamiliar with species—and so they are light years away from understanding everything there is to know about genetic diversity. On the one hand, each individual in the same species possesses a multitude of genes that are responsible for its own characteristics. Humans have approximately 100,000, and researchers have not yet identified them all. On the other hand, genetic diversity is expressed through the existence of distinct populations within the same species. For example, some 2,000 varieties of apple have been identified worldwide. For thousands of years, humans have taken advantage of genetic diversity to domesticate wild species, particularly through cross-breeding. Today, biotechnology* allows scientists to go faster and further by creating new varieties of transgenic* plants and animals.

In nature, species are not isolated but live in relationship with larger ecological complexes, which make up, with their physical environment, the planet's ecosystems. Here again, scientists acknowledge that they know very little about how ecosystems work (see pp. 26-27) and the role they play in the diversity of living organisms. ■

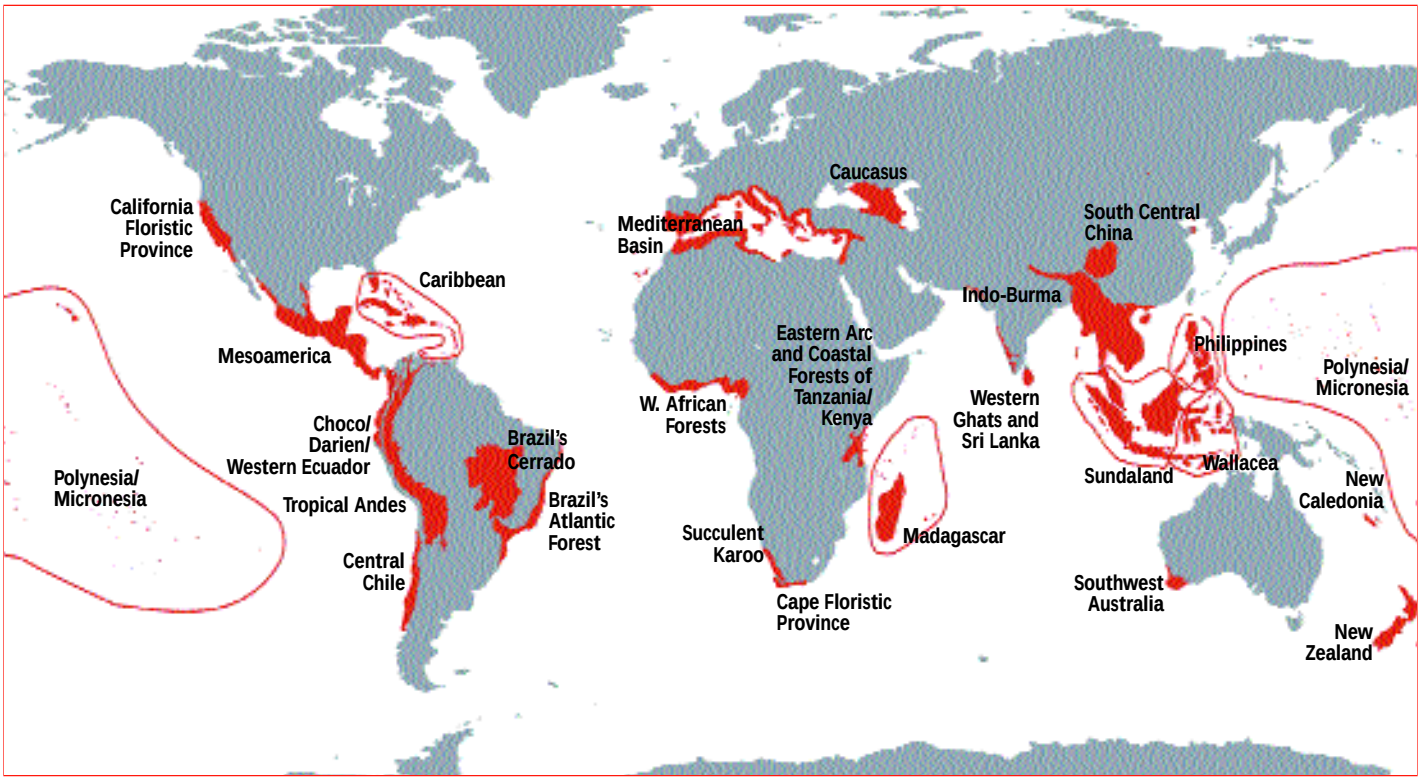
Known and estimated total number of species

Species	Known number	Estimated total number	Accuracy
Insects	950 000	8 000 000	poor
Fungi	70 000	1 000 000	poor
Arachnids	5 000	750 000	poor
Nematodes	15 000	500 000	poor
Viruses	5 000	500 000	very poor
Bacteria	4 000	400 000	very poor
Plants	250 000	300 000	good
Protozoans	40 000	200 000	very poor
Algae	40 000	200 000	very poor
Molluscs	70 000	200 000	moderate
Crustaceans	40 000	150 000	moderate
Vertebrates	45 000	50 000	good
World total (all groups)	1 700 000	12 500 000	very poor

Source : World Conservation Monitoring Centre ;Global Environment Outlook 2000 (UNEP, Earthscan).

* These terms are defined in the glossary opposite.

Biodiversity in Questions, a series of colour wallcharts for teachers and students, published by UNESCO/MAB in 1998.
Global Biodiversity Assessment, UNEP/Cambridge University Press, 1995.
www.wri.org
www.iucn.org
www.conservation.org



Source: Conservation International

Glossary

Biotechnology: any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify agricultural or industrial products or processes

Conservation: sound management of biological resources, ensuring their long-term viability

Ex situ conservation: conservation of elements of biological diversity outside their natural habitat

In situ conservation: conservation of ecosystems and natural habitats, maintenance and reconstitution of viable populations of species in their natural habitat, and,in the case of domesticated and cultivated species, in the habitat where their distinctive characters developed

Ecosystem: a dynamic complex of plant,animal and micro-organism communities and their non-living environment interacting as a functional unit

Species: a group of organisms which are naturally capable of interbreeding because of their genetic and physical resemblance

Endemic species: species present within a localized area (e.g.an ecosystem,island, or country)

Protection: prohibition or reduction of human activities in natural areas in order to maintain biodiversity

Taxonomy: the study, designation and classification of living forms

Transgenic: used to describe a living organism into which genetic material has been introduced from another species in order to cause new characteristics to appear ■

Plants seem
to have been sown
with profusion over the
Earth like
the stars in the sky to
invite man
by way of pleasure and
curiosity to
the study of nature.

Jean-Jacques Rousseau,
French writer and philosopher
(1712-1778)

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The Earth's 25 "hotspots"

What can be done to ensure that every dollar invested in the conservation of biodiversity pays off? The selection of 25 "hotspots",the most ecologically rich places on the planet,is one step towards answering that question.

A team of researchers led by British scientist Norman Myers (Oxford University) and the NGO Conservation International made the selection. They hope that their choice will lead to a worldwide conservation campaign focused on the 25 sanctuaries. Most of the sites are in the tropics. Five of them are in the Mediterranean region. Their conservation will probably cost $500 million a year.

Taken together, the sites cover an area as large as Greenland (1.4 per cent of the Earth's surface) and may harbour 44 per cent of the Earth's plant and 35 per cent of its vertebrate species. They do not include areas rich in endemic species that are not yet under threat from humans. For example, the forest in French Guyana has a population density of under five inhabitants per km^2, but according to a recent report by the NGO Population Action International, the population density in the 25 "hotspots" is twice as high as the world average.

Although this approach may be effective, it is not universally accepted by the scientific community. Critics argue that too little is known about the geographical distribution and richness of biodiversity to identify priority areas. They say the 25 hotspots are too focused on tropical forests and neglect deserts, meadows, tundra and temperate forests, as well as the wealth of marine biodiversity. ■

Doomed to early demise

Edward O. Wilson

Many biologists believe we are in the midst of one of the great extinction spasms of geological history. This time however, human activity, not nature, is the culprit

In the Amazon Basin the greatest violence can begin as a flicker of light beyond the horizon. There, in the bowl of the night sky, an approaching thunderstorm sends lightning bolts that illuminate the wall of the rain forest. Spear-nosed bats fly through the tree crowns, palm vipers coil in the roots of orchids, jaguars walk the river's edge, and around them grow 800 species of trees, more than are native to North America. A thousand species of butterflies,six per cent of the entire world fauna, wait for the dawn.

About the orchids, we know little. About the flies, beetles, and fungi we know almost nothing. Rainforests like the Amazon with their myth-inspiring plants and animals are still mostly unexplored. Biologists believe that they shelter more than half of the world's plant and animal species. Tragically, they are being quickly torn down by human activity. It is difficult to assess quantitatively the loss of species there and elsewhere because we do not know the precise number of species that exist on earth. Probably fewer than 10 per cent of them have even been given a scientific name. And extinction is hard to observe. We don't see the last butterfly of its species snatched from the air by a bird or the last orchid of a certain kind killed by the collapse of its supporting tree.

We know from the fossil record that six great extinction events have occurred in the past half billion years. The latest of these events, caused by a giant meteorite strike near present-day Yucatan (Mexico) 65 million years ago, ended the age of dinosaurs. These catastrophes variously obliterated 30 to 90 per cent of the world's plant and animal species. Afterward,evolution replaced the biodiversity very slowly, during periods of millions of years.

Equilibrium

Biologists agree that we are now in the earliest stages of a seventh mass extinction event, caused not by an act of nature but entirely by human activity. The current rate of extinction is generally estimated to be 100 to 1,000 times higher than it was before the origin of modern humanity about half a million years ago. Throughout most of the geological past, individual species and their descendants lived for an average of roughly one million years, and disappeared naturally at about one species per million each year. On a grand scale, new species replaced vanishing ones at about the same rate. No

Forests precede people.
Deserts follow them.

François René de Chateaubriand, French poet (1768-1848)

© Rudolph Konig/Jacana, Paris

In Sumatra,Indonesia,a Kubu tribesman contemplates a calcinated forest area,used by generations for hunting and gathering medicinal plants.

© Mark Edwards/Still Pictures, London

Professor of Science and Curator in Entomology at Harvard University and the winner of many scientific awards in addition to two Pulitzer prizes for his books, in particular The Diversity of Life (Harvard University Press, 1992), which inspired this text.

© Kevin Schafer, 1999

The Russian forests are going down under the ax.
Millions of trees are perishing, the homes of wild animals and birds are being laid to waste, the rivers are dwindling and drying up, wonderful scenery is disappearing never to return. (…)
The climate is ruined, and every day the earth is growing poorer and more hideous.

Anton Chekhov,
Russian writer (1860-1904)

more. Not only has the extinction rate soared, but also the birth rate of new species is falling as the natural environment is reduced by human action.

According to estimates by the World Conservation Union (IUCN), about one quarter of the world's mammals and more than a tenth of its remaining birds are at a high risk of extinction. One-fifth of all reptile species, a quarter of all amphibians and as many as 34 per cent of all fishes (mostly freshwater species) are in similar jeopardy. And these proportions only refer to species we know relatively well. In the less studied groups, more than 500 insect species, 400 crustaceans and 900 molluscs are also threatened, according to IUCN, figures that are surely vast underestimates. Finally, about an eighth of the world's flowering plants are edging toward extinction.

Human demographic success has brought the world to this crisis. Human beings have become a hundred times more numerous than any other large land animal in the history of life. By every conceivable measure, humanity is ecologically abnormal. Our species appropriates between 20 and 40 per cent of solar energy captured in organic material by land plants. There is no way we can draw upon the resources of the planet to this degree without reducing many other species to rarity or extinction.

The leading cause of the decline is the destruction of natural habitats to make more room for urban and farming areas and to extract timber, ore, and other natural resources. Not many habitats in the world covering a square kilometre contain fewer than a thousand species of plants and animals. Patches of rainforest and coral reef harbour tens of thousands of species, even after they have been partly chipped away by human intervention.

But when an entire habitat is destroyed, almost all of the species specialized to live in it are destroyed. Not just eagles and pandas disappear but also the smallest, still uncensused invertebrates, algae and fungi, the invisible players that make up the foundation of the ecosystem.

Celebrity pandas

For years, conservationists often focused on saving "star" species like pandas as opposed to the entire ecosystem in which they live. Now, with a better understanding of the extinction process, they have switched gears by, for example, focusing on the need to protect particularly rich environments that contain numerous vulnerable species, referred to as biodiversity "hotspots" (see page 21).

The second major cause of extinction is the invasion of alien species. When Polynesian voyagers set shore in Hawaii around 400 A.D., the islands were a special kind of paradise. Their lush forests and fertile valleys contained no mosquitoes, ants, poisonous spiders nor snakes or plants with thorns or poisons. All these are now abundant. Human commerce introduced invasive species, deliberately or by accident. As the natural habitats were decimated and the alien invaders pressed on, the original fauna and flora have retracted. Most are now rare or extinct.

The third major cause of decline is pollution. Freshwater faunas and floras, for example, are especially vulnerable to the increasing flood of industrial and agricultural pollution. The fourth agent of destruction, destined to rise in importance in the future, is global warming, which itself is the result of pollution by excess greenhouse gases. Among the more fragile environments most threatened are the arctic tundras and the unique South African fynbos (scrubland) "trapped" on the tip of the continent.

Shrinking rainforests

Just how fast is diversity disappearing? We are far from an exact answer, except to say, "catastrophically fast". Yet it is possible to get a handle on the richest environment of all, the tropical rainforests. By looking at the rate of reduction of the forest area, we can roughly estimate the extinction rates of species. First, we must dispel the myth of the regenerative power of rainforests, which are actually among the most fragile habitats. More than half of the area of the forest surface worldwide consists of acidic and nutrient-poor soil. When the forest is cut and burned by farmers, the ash and decomposing vegetation flush enough nutrients into the soil to support vigorous new herbaceous and shrubby growth for two or three years. But as the nutrient levels decline, the land can no longer support healthy crops and forage. So the farmers must add fertilizer or move on to slash-and-burn the next patch of forest.

In prehistoric times, the great forests—the greenhouses of planet Earth—covered 14 to 18 million square kilometres. Only about half of the original area remains. Much of the destruction is recent, with about one million square kilometres cleared every five to ten years. If this destruction rate continues, a quarter or more of the remaining rainforest will be gone by 2025.

Now let's conservatively assume that the forests presently shelter 10 million species and focus exclusively on the impact of deforestation. We won't even consider species lost to over-hunting or those erased by new diseases, alien weeds and animals such as rats. Within these cautious parameters, 27,000 species are doomed each year. In other words, 74 will disappear or start their descent to endangered status every day, three each hour.

If rainforests are as rich in diversity as most biologists think, their reduction alone will eliminate at least five to ten per cent of all the species on earth. I think that a far greater number of species are on the edge, perhaps irreversibly so.

Clearly we are in the midst of one of the great extinction spasms of geological history. Humanity needs a moral awakening together with all of the scientific and technological ingenuity it can bring to bear, in order to avoid impoverishing the planet for all generations to come. We can, we must find the way. ■

Too valuable for price-tags

Sophie Boukhari

Why should biological diversity be protected? Scientists are putting forth many new answers: some to convince the public and decision-makers and others they consider scientifically valid

Every week it seems, biologists, anthropologists or environmental scientists publish studies with a new reason explaining why it is vital to slow down the depletion of biodiversity. For example, in early March two American scholars, James Kirchner and Anne Well, wrote in the British review *Nature* that, after an era of mass extinction, it took nature much longer than anyone had previously thought to reach its current level of richness and diversity.

If humans continue destroying wild habitats at the current pace, not only will we cause a major new crisis in the history of life, it will take nature at least 10 million years to recover. That stunning argument bemuses some scientists, who say that in just five million years, *Homo sapiens* and the other large vertebrates will have gone the way of the dinosaurs. So why care about what happens after that?

"The question is not what will happen to tigers 10 million years from now," says Michel Batisse, who helped set up UNESCO's biosphere reserves and is on the board of directors of the non-governmental organization Conservation International. "There's no doubt they will no longer exist. But what about 100 years from now? What we need is to find good reasons to protect biodiversity in the next few centuries."

The tempestuous debate over the "value" of biodiversity is sometimes skewed by the need to convince at any price. Genuinely alarmed about the scope of the destruction, some experts have taken up "ideological" positions, says Talal Younes, executive director of the International Union of Biological Sciences. "They think any argument that can help put the message across is good, whether or not it is scientifically valid."

The values most commonly invoked to raise public awareness are economic and aesthetic. "The Western public pictures biodiversity like Noah's ark, with the giraffe and the sequoia, the parrot and the tulip," says Batisse. In the industrialized countries, where wilderness has become a rare, highly-prized commodity, people are willing to take action so that their grandchildren will have the chance to see elephants roaming free.

But Peter Bridgewater, director of UNESCO's ecological sciences division, thinks biodiversity's aesthetic value is relative. "People living in cities in New Zealand, for example, think that whales are in great danger and should be protected from hunters. But Inuit in Alaska will tell you that whales are an important part of their diet and that they should be allowed to sustainably hunt whales. Who is right? "

A gene pool for biotechnology

The aesthetic argument works with a certain segment of the general public, but it falls short of convincing decision-makers. "When ministers hold a meeting, you have to demonstrate the economic advantages of preserving biodiversity," says Batisse. That task is all the harder because governments sometimes derive tremendous economic benefit from the destruction of ecosystems, especially forests, and they are under pressure from powerful lobbies (the timber and paper industries, for example). Researchers reply that biodiversity is a boon for the tourism industry (see pp.31-32), helps to cure illnesses (pp.30-31) and to feed people at little cost (pp. 27-29) and constitutes an inestimable gene pool for biotechnology.

In the past several years, scientists have also come up with a battery of figures aimed at putting a monetary value on the services ecosystems provide for human societies (see pp. 26-27). A group of American scholars estimates their worth at $319 billion a year in the United States (5 per cent of the U.S. GDP), and nearly three trillion dollars a year worldwide. The leading ecological economist, Robert Costanza, has published other estimates assessing the total value of services rendered by biodiversity at $33 trillion a year—more than the GDP of all the world's countries combined.

UNESCO Courier journalist

© Frans Lanting/Minden Pictures, California

In Madagascar, an Antandroy tribesman holds the fossilized egg of an elephant bird (Aepyornis maximus), a species that became extinct about 500 years ago.

The Earth is our mother,
the eagle
our cousin.
The tree draws
blood from us and the
grass is growing.
Our ancestors
told us:
Now that we have done
all these things, you
must watch
over them
and ensure that they are
forever.
It is in this way
that human beings
became
the custodians of
the planet.

Gagudju account of creation (Australia)

© Gérard Lacz/Sunset

While these figures might hit home, many scientists consider them to be totally off the mark. Peter Bridgewater goes even further, arguing that the attempt to put price-tags is not only a "waste of time" but dangerous. "The economically-minded people are setting up a system of discrimination by considering some species and ecosystems to be valuable (because they provide 'profitable' services) and deeming others worthless. Ecological systems are not built-up on the basis of discrimination but co-operation. They must be considered as a whole."

Bridgewater says biodiversity is too valuable to be evaluated. It is priceless because it guarantees the security of the human race. It would be idiotic, he says, to destroy ecosystems which make air breathable, the climate tolerable, water drinkable and soil fertile (see pp. 26-27). To those who argue that technological progress will offset environmental damage, he retorts that the costs would be exorbitant. And technological solutions, he adds, will not hold up in the long run because, unlike nature, they will be incapable of adapting to change. What's more, adds Jeffrey McNeelly, of the World Conservation Union, the most advanced technologies are based on mechanisms observed in living things—an additional reason to take care of them. Instead of pitting nature and technology against one another, biodiversity specialists are counting on an alliance between them to better manage the environment and to develop ecological engineering (which would make it possible, for example, to restore the functions of a degraded tropical forest).

Last but not least, they say, instrumentalist arguments pale in comparison to the only one that really matters: biodiversity is the essence of life. "What is life, when you get down to it?" asks Robert Barbault, director of the French Institute of Basic and Applied Ecology. "It is what lasts. And it lasts because it adapts to changes in the environment by diversifying. A host of species has continued demonstrating this for over four billion years. Humans are no different, even though they are more sophisticated. They face the same problems: eat or be eaten. Predators try to kill as much prey as possible and prey tries to escape from predators. That leads to co-evolution based on genetic and behavioural variability. It's a race that never ends," says Barbault. "Diversity is the very reason for the success of living phenomena, and therefore for our own existence." But if living things have always adapted, why worry now? Most specialists are categorical: to regenerate, life needs time and space, two things it no longer has because of the pace and scope of the damage caused by people.

Becoming aware of our interdependence

Because of its biological and technological progress, *Homo sapiens* are jeopardizing their own welfare. The present environmental crisis, says Robert Barbault, has the advantage of helping to raise the Western individual's awareness of our connections with nature, which has long been considered as an external entity to be tamed. "We're beginning to understand that our planet must be managed and, consequently, to think about the new civilization we want to build. The ability to conceive a project is precisely what sets us apart from other species. We will have to change our behaviour, especially diet and technology, and our mentalities. We must have a different, more ecological vision of the world and be more aware of our interdependence with all other living things." And perhaps, a touch more humble. ■

Ecosystems, our unknown protectors

José Sarukhán

How ecosystems work and what part they play in biodiversity remain a mystery. But we do know that they perform a host of invaluable services for the human species

In my view, biodiversity's fundamental value is neither aesthetic nor economic but environmental, even though most people are largely unaware of this. The value of biodiversity is often measured in terms of the number of species living in a given area. But the interactions between the many species in an ecosystem, and between them and the environment's physical and chemical components are also very important. This highly intricate web of relationships makes an ecosystem more valuable than the sum of the species it contains.

Ecosystems perform services that are essential for the survival of the human species. They fix carbon in the atmosphere and produce oxygen, protect soil from erosion and keep it fertile, filter water and replenish aquifers, provide pollination and anti-parasite agents and so on.

The first two of these services are closely related to each other. They result from photosynthesis, whereby green plants, starting with algae, absorb carbon dioxide (CO_2) and emit oxygen. For millions of years, the balance between the various gases in the atmosphere remained stable. But with the coming of the industrial revolution, humans began burning increasing amounts of fossil fuels. Today, three billion tonnes of carbon build up in the atmosphere each year, and natural ecosystems can no longer absorb all these emissions—especially since they are disappearing at an alarming rate. Deforestation alone releases such tremendous amounts of CO_2 and other gases, such as methane, that it has become the second-leading cause of global warming.

Storing freshwater, protecting soil and keeping it fertile are three other closely related functions. Ecosystems are veritable "freshwater factories". They absorb rainwater and slowly filter it through the soil before draining it towards streams, rivers, lakes and underground aquifers that supply us with the precious liquid.When the vegetal ground cover is degraded, the water cycle is disrupted. Rain strikes the bare earth, washing away huge amounts of nutritional substances. Reservoirs, lakes and rivers silt up and terrible mudslides, such as those that recently ripped

Nickel mining in New Caledonia has severely eroded the upper parts of certain massifs and has had a devastating impact on the environment.

© Jean-Paul Ferrero/Auscape, Australia

Director of the Ecology Institute at the University of Mexico City, president of Diversitas, an international biodiversity programme sponsored by UNESCO and the International Council for Science

© Michael et Patricia Fogden

It should not be believed that all beings exist for the sake of man. On the contrary, all other beings too have been intended for the sake of something else.

Moses Maimonides, theologian, Jewish philosopher and doctor (1135-1204)

through Central America, Mexico and Mozambique, kill thousands of people and cause incalculable damage.

Uncertain reaction to climate change

Despite years of research, scientists still know very little about how ecosystems work. We are generally incapable of predicting how they will react to certain transformations in the environment, especially climate changes. Nor do we know any more about whether a species present in a given environment is superfluous or "replaceable",even when it is very rare. Likewise, we do not know which key species are indispensable to maintaining an ecosystem, with a few exceptions such as pine forests, where that tree is obviously the dominant species.

We know even less about the part biological diversity itself plays in maintaining ecosystems and the services they perform. One simple example is a highly diversified forest that absorbs carbon dioxide—a vital function, as we have seen, for limiting global warming. Suppose the forest is cleared to make way for a single-crop forest. The service will still be performed, perhaps even better at first because young, fast-growing trees absorb more CO_2 than old ones, which regenerate slowly. But what will happen in the long term? After several decades, the consequences of the loss of biodiversity will probably be felt. Replacing many species with a single one will have certainly depleted the soil and, in the long term, slowed down the forest's growth and consequently its ability to absorb CO_2.

More generally, diversified ecosystems seem more productive. Specialists remain wary about their conclusions, but today they believe that biodiversity helps ecosystems to resist alien species and diseases and to recover faster in the event of disruption. In the face of doubt, and to find out more about them, it is better to preserve as many different ecosystems as possible.

A costly lesson for New York City

Most people take it for granted that ecosystems will carry on performing services without receiving anything in return. They think nature will continue benefiting humanity, no matter how much damage is done.The survival of organisms other than our own species is perceived as a frill that future generations can live without.

These preconceived ideas are wrong and dangerous, as the city of New York has recently come to realize. The city's water has always enjoyed such a good reputation that it was sold throughout the northeastern United States. Its quality was due to the Catskill Mountains' natural purification system. But that ecosystem has suffered so much from pollution, especially fertilizer run-off from farms, that by the late 1990s New York's water had become undrinkable. The city planned to build a purification plant, whose cost was put at between six and eight billion dollars, not including the $300 million in yearly operating costs—an astronomical bill for a service that had always been free! The price was so staggering that the city eventually decided to restore the Catskill Mountains' degraded environment at a cost of only one billion dollars.

This story clearly illustrates where our interests lie. We must preserve ecosystems and the conditions that enable our planet to ensure the survival of *Homo sapiens* or, at least, the short-term maintenance of our current quality of life. ■

Genetic diversity and food security

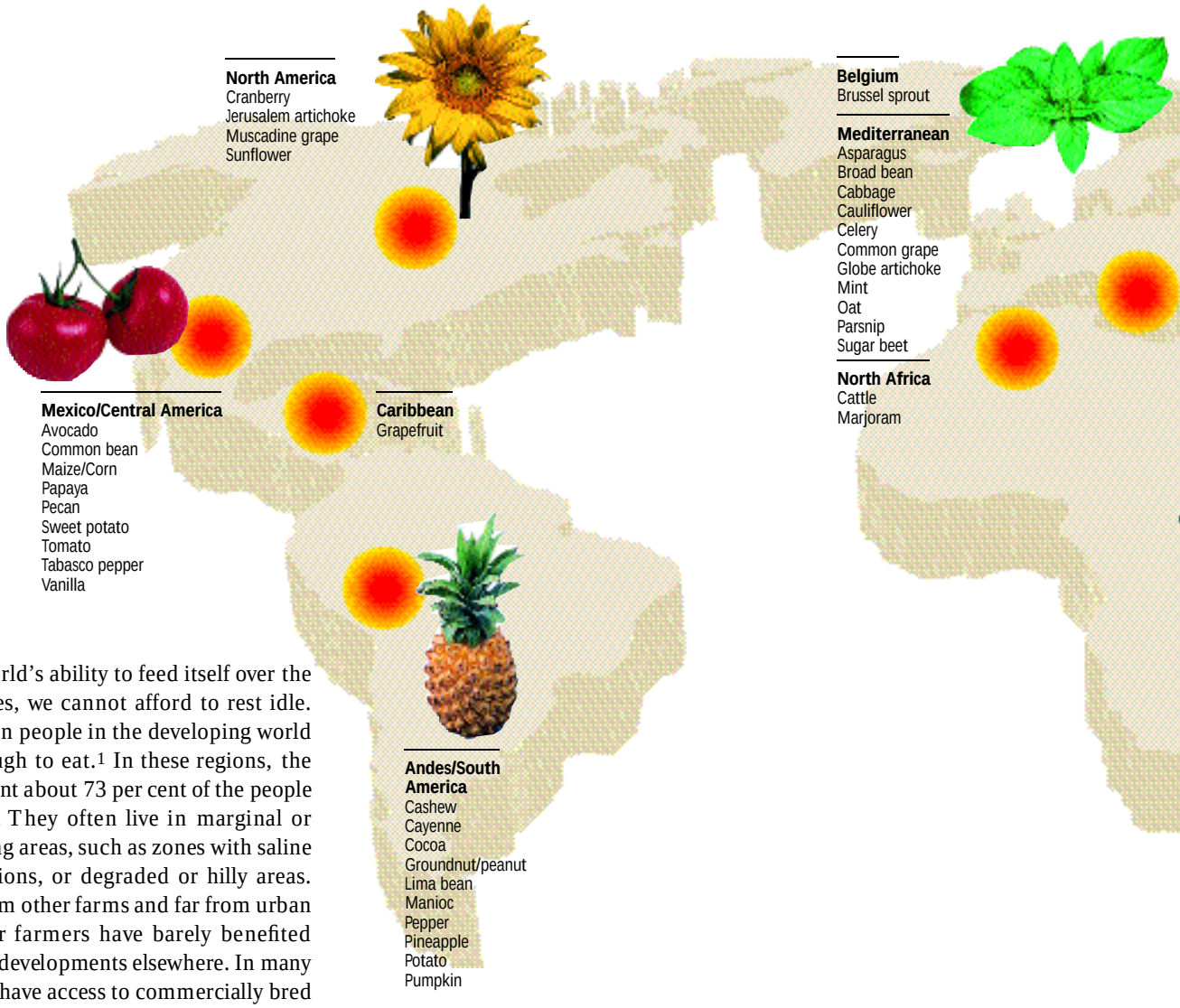
◗ Geoffrey C. Hawtin

Maintaining a diversity of crops and varieties is a key to survival for millions of farmers living on impoverished land

◗ Director General of the Rome-based International Plant Genetic Resources Institute, devoted to promoting the conservation and use of plant genetic resources

For thousands of years, farmers have used the genetic variation in wild and cultivated plants to develop their crops and raise new breeds of livestock. Genetic diversity gives species the ability to adapt to changing environments, including new pests and diseases and new climatic conditions. Plant genetic resources—that component of genetic diversity of actual or potential use to humanity—provide the raw material for breeding new varieties of crops. These, in turn,provide a basis for more productive and resilient production systems that are better able to cope with such stresses as drought or overgrazing and can reduce the potential for soil erosion. The use of genetic diversity—on-farm, through field experimentation or in sophisticated gene transfer procedures—remains arguably the best route to securing our food and that of our children.

Although science has made enormous strides in ▶



▶ improving the world's ability to feed itself over the past three decades, we cannot afford to rest idle. Nearly 800 million people in the developing world do not have enough to eat.[1] In these regions, the rural poor represent about 73 per cent of the people living in poverty. They often live in marginal or unsuitable farming areas, such as zones with saline soils, arid conditions, or degraded or hilly areas. Often isolated from other farms and far from urban areas, many poor farmers have barely benefited from agricultural developments elsewhere. In many cases they do not have access to commercially bred high yielding crop varieties. Diversity flourishes and remains important under such conditions.

Selections and breeding

Poor farmers are well aware of the relationship between the stability and sustainability of their production systems and the diversity of crops and crop varieties on their lands. Their management and use of a diverse range of plants has often helped them to survive under the most difficult conditions. By growing a range of different crops, farmers have a better chance of meeting their needs. These might be crops that mature at different times or that can be easily stored to help to ensure a stable food supply throughout the year. They may also help farmers provide a nutritionally balanced diet for their families, exploit different environmental niches that exist on their land, or diversify their income sources.

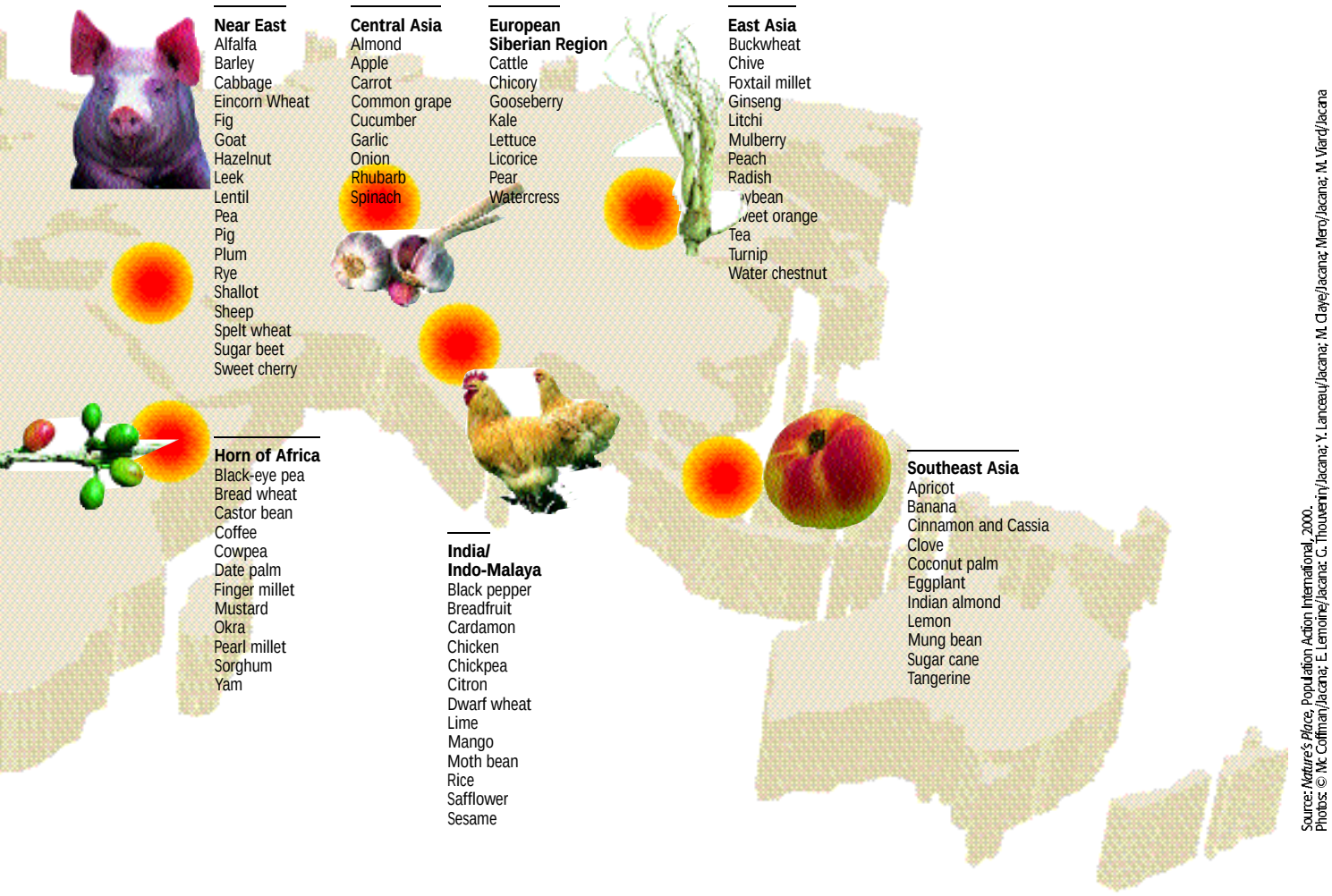
Importantly, the genetic diversity contained in different varieties provides farmers with options to develop, through selection and breeding, new and more productive crops that are resistant to pests and diseases. The result may be a vast range of local varieties of crops grown by farmers in any one area. In the Andes, for example, farming communities use about 3,000 different varieties of potatoes, and in Java farmers may plant more than 600 species in a single home garden.

1. See the Food and Health Organization's *1999 Report on the State of Food Insecurity in the World.*

Not respecting diversity can incur high costs: in 18th-century Ireland, where potatoes were the only significant source of food for about one third of the population, farmers came to rely almost entirely on one very fertile and productive variety, which proved susceptible to the devastating potato blight fungus. The resulting famine caused the death or emigration of more than 20 per cent of the population.

The value of diversity goes well beyond its ability to support stable production systems in marginal environments. As the world's human population rises, environmental problems (desertification, deforestation, erosion, etc.) are intensifying. Climate change, particularly global warming, could bring about drastic changes in the location of the world's agro-ecological zones. Farmers will require new crop varieties capable of producing under diverse conditions, without adding ever-increasing amounts of fertilizers and other agro-chemicals. Because of the limited scope for growth in the world's cultivated areas, each new generation of varieties will have to be more productive than its predecessors.

Much has been written about the use of genetic engineering in plant breeding. Modern molecular techniques can be used to transfer genes from one living organism to another or to change the genetic material within to produce more desirable traits. Genetic engineering has enormous potential to help solve problems that have proved intractable using conventional breeding approaches, such as developing



Source: *Nature's Place*, Population Action International, 2000.
Photos: © Mc Coffman/Jacana; E. Lemoine/Jacana; G. Thouvenin/Jacana; Y. Lanceau/Jacana; M. Claye/Jacana; Merp/Jacana; M. Viard/Jacana

crop varieties with in-built resistance to key pests and diseases and tolerance to stresses such as drought. However, the possible impact of these techniques, particularly on human health and the environment, is giving rise to fierce worldwide debate.

Take the case of banana and its close relative plantain, two of the developing world's most important crops. Their improvement is hindered by the sterility of most cultivars, a problem that can be addressed through genetic engineering. It is now possible to transfer gene constructs, such as those associated with disease resistance, directly into varieties with other desirable characteristics, drastically reducing the need for pesticides. Currently, many crops are sprayed more than 40 times with fungicides to control the devastating banana and plantain disease, Black Sigatoka. The first transgenic banana and plantain plants have been produced and are now undergoing testing.

Today, research on genetic engineering is focused on the development of commercial varieties of the world's major crops of interest to industrialized farmers. Many of the staple crops of importance to poor farmers in developing countries, such as cassava, bananas, beans and yams, have received relatively little attention. This situation is likely to continue as plant breeding is increasingly privatized and biotechnology becomes the fast-growing province of private industry. Meanwhile, the high costs of the new technologies are quickly exceeding the capacity of many, if not most, public research institutions—both in developing and developed countries—to support them. Thus, for the time being, increasing agriculture's role in the development of the world's poor is likely to continue to depend on the identification, maintenance and use of genetic diversity. ■

To market in Peru: farmers in the Andes cultivate up to 3,000 potato varieties.

© Ron Giling/Lineair, Arnhem

Website of the International Plant Genetic Resources Institute: www.cgiar.org/ipgri

Out of the forest and into the bottle

Cécile Guérin

Pharmaceutical companies are taking an increasing interest in plants, insects and bacteria. But from nature to clinical trials, the road is a long one

© Patricio Estay/Dune/Explorer, Paris (INBIO)

Collecting species: a "bioprospector"on the job in Costa Rica.

In Madagascar's Isalo mountain range, the guide stops. At his feet, a tiny flower displays its pink petals. "This plant is good for cancer," the man says proudly. Long consumed to relieve hunger, the Madagascar periwinkle was first described by the French botanist Etienne de Flacourt in 1645. Then, in the 1960s, it was discovered to be effective in treating cancer.

Humans have always found substances in nature to relieve their suffering and cure their ills. In developing countries, 80 per cent of the population relies on traditional remedies extracted from plants to treat illnesses. Some "modern" drugs that contain a single active ingredient rather than a mixture of substances owe their existence to natural biodiversity. Morphine, quinine, digitaline and 116 other drugs made from plants are in widespread use, according to American pharmacologist Norman Farnsworth. An estimated two-thirds of the drugs sold in pharmacies are of natural origin. They account for some $30 billion in sales every year.

There is an urgent need for therapeutic research to find new treatments that can be helpful in fighting recent, emerging diseases such as Aids as well as overcoming resistance to current treatments for cancer, malaria and bacterial infections. Researchers are following several leads, such as gene therapy, which is still in its earliest stages, and drug design. With the advent of molecular biology, they have begun designing tailor-made drugs. Knowing the shape of a given biological "lock", they use computers to design the molecular "key" that may trigger the mechanism resulting in a cure. This method works in theory, but in practice it is extremely complicated to create *ex nihilo* an artificial substance that is not found in nature. Hence the advantage of combining natural molecules that result from 4.5 billion years of evolutionary development.

Recent successes have confirmed the value of using substances from nature. The discovery of cyclosporin, an immunosuppressant, in a Norwegian mushroom has led to decisive progress in preventing the rejection of transplanted organs. Researchers working for the American pharmaceutical giant Merck & Co. have recently detected a chemical component in a Congo mushroom that acts like insulin and may be used to make the much sought pill for diabetes. At the same time, *in vitro* methods for detecting active molecules have evolved. Pharmaceutical companies have giant robots capable of testing up to 100,000 samples a day.

Calling on local healers

Nevertheless, in practice the road leading from plant to drug is still extremely long and fraught with uncertainty. First, samples must be collected in strategic places, where primary forest survives. They are located in "countries in the inter-tropical zones of Africa, South America, Asia and the Pacific," says Thierry Sévenet, research director at the French Institute for Natural Substance Chemistry.

In the field, biological prospectors are following three different and complementary leads. Scientists collecting plants at random bring back as many samples as they can for screening by robots. But the traditional knowledge of local healers can narrow down the search. Folk remedies have led to the development of several drugs, starting with quinine and digitaline. Researching in the South Pacific, American ethno-botanist Paul Cox recently studied a stem of *Homolanthus nutans* that Samoans prepare for the treatment of fevers. Chemists scrutinizing the plant found that it contains a known molecule, prostratine, which acts upon the Aids virus. Lastly, using the

French science writer

© Roucaire/Jacana, Paris

Nature's medicine chest

Relieving pain
1817[1]: morphine is extracted from poppy flowers.
Treating inflammation
1829:aspirin is extracted from willow bark.
Regulating heartbeat
1868:digitaline is extracted from digitalis.
Fighting malaria
1820:quinine is extracted from cinchona bark.
1972:artemisine is extracted from artemisia.
Preventing the rejection of transplanted organs
1970:cyclosporin is extracted from a Norwegian mushroom.
Fighting cancer
1958-1965:the derivatives vinblastine and vincristine are extracted from the Madagascar periwinkle.
1971:taxol is extracted from the Pacific yew.
1980:taxotere is extracted from the European yew.

1. Dates refer to the isolation of the active ingredient, usually 10 to 15 years before the drug is marketed.

chemo-taxonomic approach, scientists probe species from the same family already reputed for containing useful substances.

Once the samples are gathered, chemists take over, extracting and purifying substances from the raw material in order to produce mixed or pure chemical components. Then, the extracts are tested to determine whether they are biologically active. At this stage, the screening process is extremely thorough. Generally, a single molecule is kept out of 10,000 compounds analysed. Altogether, it takes 15 to 20 years from the time the plant is gathered in the forest to the final clinical trials conducted before a drug can be marketed.

Profit-sharing

Pharmaceutical research is sluggish and uncertain, while the threats to biodiversity are irreversibly and rapidly gaining ground (see pp. 22-23). In the face of this urgency, which coincides with rising interest on the part of researchers, prospecting projects are being developed, despite the increasingly strong constraints on the industry. Before the 1992 Earth Summit in Rio de Janeiro, Western laboratories—the only ones that can afford to invest huge sums in research—drew from the biodiversity of the Southern countries without giving them anything in return. But in the past ten years or so, these countries have demanded a share of the profits—and pharmaceutical companies are beginning to listen. In 1991, for the first time, Merck & Co. paid over one million dollars to INBIO, Costa Rica's National Institute for Biodiversity, to gain access to the country's genetic resources. If a drug is developed, the institute will receive between two and six percent of profits, of which half must be earmarked for the preservation of national parks. In five other projects carried out by the United States with South American and African countries, U.S. universities are co-operating with local ones. It remains to be seen how the indigenous people who help in the selection of plants will be remunerated.

In the shadows of the world's big pharmaceutical companies, smaller local laboratories have joined the green gold rush. Madagascar's Institute of Applied Research has begun a study of 12,000 native plants. Working with France's Natural History Museum, the institute has identified a substance that strengthens the effectiveness of chloroquine against malaria. With a bit of luck, this plant from the *Strychnos* family will follow the same trail blazed by the Madagascar periwinkle. ■

Borneo: reaping the fruits of ecotourism

Robert Basiuk

The Iban people are highly dependent on the riches of the forest for their survival, and tourism has become an added incentive to protect this wealth

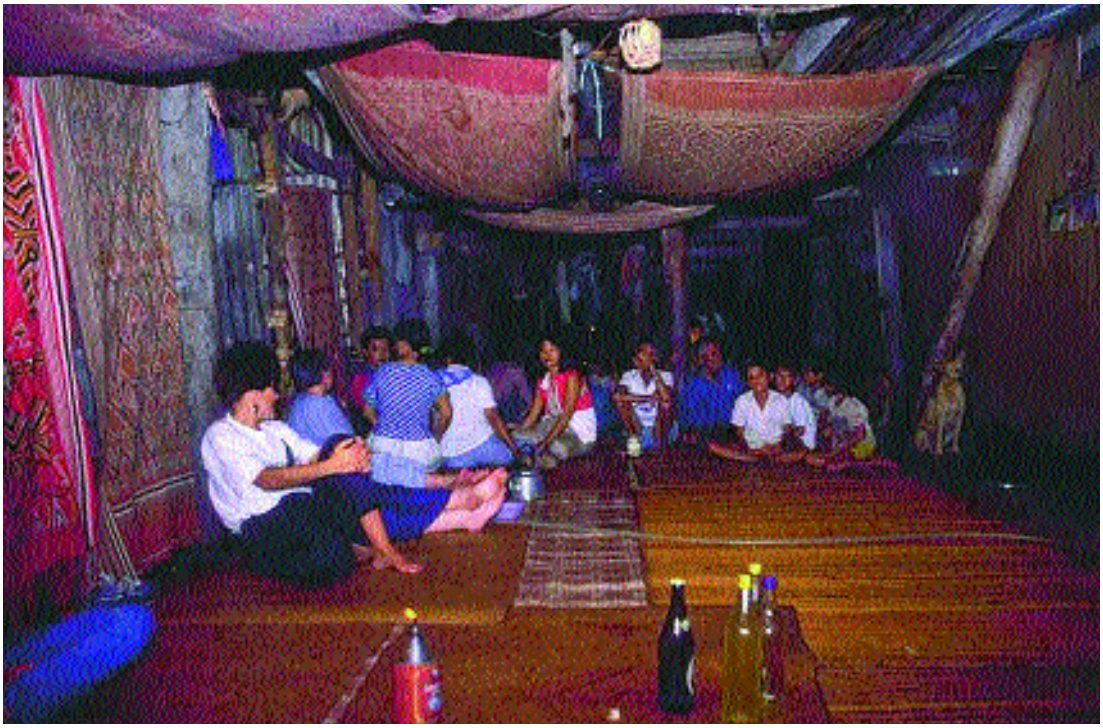
Since they settled in the Malaysian state of Sarawak over 400 years ago, the Iban have made the surrounding rainforest their supermarket and hardware store, tapping the tremendous variety of plants, animals and raw materials for their food,medicines, dwellings and rituals.

This region of northwestern Borneo is identified as one of the world's most biodiversity-rich areas. Its resources are so important to the Iban that local customary laws stipulate taboos against felling certain trees, killing various animals and cutting forest areas containing valuable fruits and construction materials.

The traditional Iban dwelling is the longhouse, a semi-permanent structure housing 20 or more families in separate living apartments. Their main livelihood is from farming (hill rice), fishing, small-scale rearing of livestock,gathering of jungle produce and occasional hunting. Until recently, resins, rattans, animal products and scented wood were among the important items exchanged for non-forest goods such as steel and cloth. Demand for some products has ceased and with it their value as a barter trade item. Transition towards a cash economy has also changed the needs of the villages. While supplies of rattans and sandalwood have diminished, tourism has emerged as a new market for biodiversity over the past ten to fifteen years.

Ulu Ai, established by the Kuching-based operator Borneo Adventure, is one example of a new generation of tourism products promoting the intricate relationship between the rainforest and its dwellers. The Ulu Batang Ai is a remote, unspoilt area: the rivers are tree-lined and clear and the landscape is rugged with steep hills giving rise to many waterfalls.

Canadian biologist who has lived in Sarawak (Malaysia) since 1983. Mr Basiuk has served as a wildlife officer for the Sarawak National Park,held various senior positions with the state tourism board and helped to set up Borneo Adventure. Since 1998,he has worked as a consultant on a variety of projects related to tourism and natural resource management.



© Robert Basiuk, Malaysia

In Sarawak,the Iban people welcome some 1,000 tourists every year into their longhouses.

Beyond the Ai river are the Lanjak Entimau Wildlife Sanctuary and the Batang Ai National Park,established to protect the last wild population of orang-utan. While the Iban living in this area are reasonably self-sufficient in terms of food and can manufacture most of their daily necessities from local materials,they did not—until recently—have a steady cash income as the distance from markets makes cash crop farming and market gardening unfeasible.

Premium orang-utan

The village was first approached in 1986, shortly after Borneo Adventure had been formed, to see if its inhabitants would be interested in receiving visitors in their longhouse. The arrangement proposed was that the village would provide transport,guides, food and accommodation and Borneo Adventure would bring in the tourists. From the start, the project aimed to bring visitors to experience the longhouse and up-river lifestyle and to provide an incentive for the community to conserve the local wildlife—in this case cash earned from taking tourists on jungle hikes.

The area is prized for its orang-utan population, a totally protected species although sporadic hunting by outsiders has occurred in the past.While local farmers would not harm the orang-utan themselves, they were reluctant to protect them from outside hunters, as they can cause extensive damage. Because local village guides are tipped over and above their daily wage when orang-utan are seen, longhouse people now view this species as a precious commodity, keeping track of their movements and informing authorities if hunters are believed to be in the area. A secondary benefit has been the rekindling of traditional stories and lore concerning the links between the Iban and the orang-utan, which are often referred to as “grandfathers”.

The village involvement in tourism has also benefited other wildlife in the area. Fish catches have recovered from the pre-tourism days when one of the few sources of cash income was to sell the fish to down-river buyers. With no control over catch rates, the stocks were in danger of being depleted—and with that an important source of protein and revenue. With a reasonably steady alternative cash flow from tourism, stocks have now been stabilized.

In 1999, 26 families received over RM 300,000 ($82,000) in tourism-related pay. In addition to the wages earned as guides, boat drivers and cooks, as well as rental for the guesthouse, the village people also earn money selling traditional handicrafts such as woven blankets ($10,000 in 1999). This income has also allowed the village to break out of the subsistence agriculture cycle and diversify their economy to include more efficient cash crops. The reduced demand for expansion onto new land means that less forest is cut, ultimately providing more habitat for wildlife.

The project receives about 1,000 visitors a year, considered a threshold number. Villagers are gradually taking on more managerial roles, such as overseeing quality control. Fearing that they could lose a valuable source of income and employment, they are also intent on ensuring that the land surrounding the longhouses is secured and managed by them. They recently presented a proposal to the government of Sarawak to this effect.Their desire is to have the state land area beyond the longhouse land and before the existing National Park officially designated as village conservation land to be managed for tourism by the village.

As of today, the government has not answered their proposal. In the meantime, visitors are still enjoying the experience of the lush, tropical Iban supermarket and sightings of wild orang-utan are on the rise. ■

© Claus Meyer/Minden Pictures

Species that go extinct are lost forever. This is not like Jurassic Park.

Stuart Pimm,
British biologist (1949-)

3 The next step

Ecoprotection: an international go-slow

Protected areas are the key to conservation policies. But how should they be run? For Seydina Issa Sylla ◗, lack of international co-operation is the biggest problem

The 1992 Rio Convention on Biological Diversity gives priority to in situ conservation in protected areas. Why?

The key aim is to conserve all the ecological elements—plants, animals, soil and water—as well as the interactions between them, which maintain the evolutionary process. This kind of approach is crucial in poor countries, which rarely have the means to put together *ex situ* conservation projects such as gene banks,zoos and botanical gardens. It also guarantees access to data on natural resources and to the results of research carried out on their territory.

Why is it a good idea to create physical land links between different parks?

Elephants, for example, migrate from dry areas to wet ones as they need to. If you try to stop them, you threaten their survival.Protected areas should be linked by corridors that allow species to move around and also permit genetic exchange between wildlife from different regions. More and more reserves these days straddle national borders.

What are biggest threats to protected areas?

Lack of international co-operation and support. African governments, which can no longer satisfy the basic needs of their populations, have downgraded the importance of protecting nature. In many countries,decentralization of authority to regional bodies has complicated park management too.You can't create new parks in Africa any more ▶

Villagers in Senegal's Niokolo Koba park are closely involved in the management of this biosphere reserve.

© Yann Arthus Bertrand/The Earth from above/Unesco

◗ Co-ordinator for West Africa of the NGO Wetlands International

and existing ones are short of everything, especially staff.

Protected areas are also under pressure from populations whose resources are getting scarcer because of poverty and environmental changes. These people are looking for new farmland, firewood and animals to hunt. The introduction of outside species like the sparrow, which was unknown in sub-Saharan Africa before 1978, is another destabilizing element, because they come to occupy the ecological space of native species and end up driving them out. Package tourism and urban expansion are other big threats, though they are less important in Africa than elsewhere.

Why do you campaign for involvement of local people in managing reserves?

Conservation efforts have sometimes failed because it was long believed that nature could be conserved without involving people. But attitudes have changed over the past two decades, thanks largely to the influence of the poor countries. Pressure on resources is constantly increasing, and local people see parks as obstacles to development. So we have to compensate these people. Instead of investing in the protected area itself, viable projects must be funded in the surrounding area. Several approaches have been tested, such as UNESCO's biosphere reserves, of which there are now 368 in 91 countries.

What have been the results?

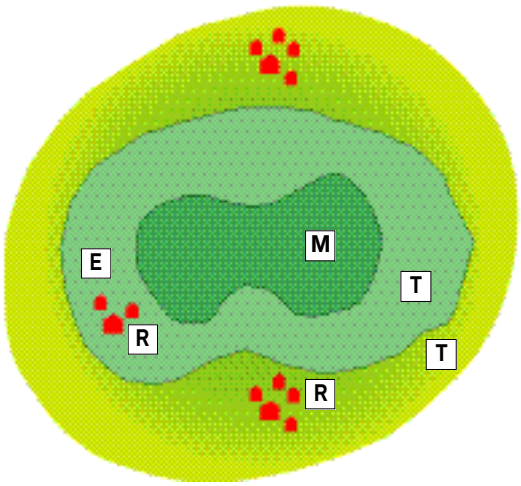
Mixed, because of lack of money. But two projects in Senegal have proved that we were on the right track. The Popenguine Reserve, for example, is the first in the world entirely run by women, who live in eight nearby villages. They maintain the park, grow food for market, manage stocks of cereals and fuel, organize visitors' accommodation and act as tourist guides. At the beginning, in 1987, they agreed to help the government run the park in exchange for permission to continue gathering medicinal plants there. They worked for 10 years without asking for a penny in payment. Then in 1997, a three-year $400,000 programme funded by the European Union and the French Nicolas Hulot Foundation, made it possible to start development projects. Now the women are independent. They patrol the reserve, looking after its conservation and benefiting from the income from tourism.

For one success, there seem to have been a lot of failures. Some people are calling for protected areas to be privatized. What do you think about that?

How can we stop the private sector from trying to improve their own fortunes? The Fazao Reserve, in Togo, was privatized in 1990. The wildlife there immediately began to be sold. That's a serious matter. There's no alternative to partnership between the state, conservation organizations and the local population. But we have to go further in the field of participation. ■

Interview by Sophie Boukhari,
UNESCO Courier journalist

Mapping a biosphere reserve



Core area
Buffer zone
Transition area
Human settlements
R Research station or experimental research site
M Monitoring
E Education and training
T Tourism and recreation

The world of protected areas

Under the 1992 Rio Convention, a protected area is "a geographically defined area which is designated or regulated and managed to achieve specific conservation objectives". This broad definition covers all kinds of situations. The World Conservation Union (IUCN), the main organization working on the development of protected areas, identifies six situations, ranging from uninhabited reserves dedicated to scientific research (the Antarctic, for example) to the countless parks run by local populations.

There are more than 30,000 protected areas worldwide, covering 8.83 per cent of the surface of the planet. Most of them are no bigger than 10 km^2 and are isolated, fragile zones in areas where nature has been subjected to human needs. A quarter of that total area (3.3 million km^2) has been classified as having exceptional value under several international agreements, including the Ramsar Convention on Wetlands (1971), UNESCO's World Heritage Convention (1972), the Statutory Framework of the World Network of Biosphere Reserves set up by UNESCO since 1976, and various European Union directives.

Some kinds of ecosystems are better preserved than others. Grasslands in temperate zones, as well as lakes, tend to be ignored in the world of conservation in favour of islands and tropical forests. What's more, as IUCN says, too many reserves exist only on paper. This is not really surprising in view of the meagre $6 billion the world sets aside each year for in situ conservation.

About $2.3 billion more would be needed to adequately protect all the reserves. Governments could come up with this money, say scientists and ecologists, simply by abolishing certain environmentally unfriendly subsidies to farmers and industrialists that amount to more than $1,000 billion annually. ■

© Joe McDonald/Auscape

Conservation means development as much as it does protection.

Theodore Roosevelt, former U.S. president (1858-1919)

Kew turns over a new leaf

David Dickson

British scientific journalist,news editor of Nature magazine

At the hub of the British Empire, Kew Gardens once scoured the world for plants. Now its Millennium Seed Bank puts it in the vanguard of international conservation efforts

For thousands of Londoners, the Royal Botanic Gardens at Kew are best known as a favourite picnic spot on the edge of the city, famous for their picturesque Palm House and Chinese pagoda, their unrivalled collection of plants and their extensive, highly manicured lawns.

The novelty of the gardens, when they were established in the 18th century, was the way in which they combined the function of cultivating a wide variety of plants with an aesthetically pleasing landscape, a sharp contrast to the formality of the plant collections that preceded them.

This remains their charm today. Visitors can wander through a selection of carefully selected and individually labelled trees, and shrubs and flowering plants from all over the world. These range from massive rhododendendron bushes from China, tropical palms grown in a spectacular Victorian glasshouse,to the smallest alpine flowers in a specially-built rock garden.

Kew played an influential role at the heart of the British Empire in the 19th century, when it acted as a central clearing house for trees and other plants discovered in one part of the empire that could be productively, and often profitably, grown in another. By the end of the 19th century, Kew was receiving over 2,500 packets of seeds a year from around the world, and exporting more than 3,500. One curator wrote that as a result of Kew's 19th-century activities the world had been "pretty well ransacked."

In the famed tropical greenhouses of the world's largest botanic garden.

© Herbert Girardet/Still Pictures, London

Biopiracy in an imperial light

It was as a result of Kew's efforts, for example, that rubber plants from South America were transferred to highly productive environments in Southeast Asia. Less controversially, Kew officials also arranged for the transfer of cinchona, source of the anti-malarial drug quinine, from its native Andes to malaria-ridden areas of Asia. "In the mid-19th century such activities reflected the then global superpower encouraging the use of plant resources," says Kew's director, Peter Crane. "Today they would be seen as pure biopiracy."

Although Kew's imperial role ended with the collapse of the empire early in the 20th century, it continued to play a major role as a research institution, preserving and cataloguing plants from across the world.

But it was only in the final decades of the century that concern for the preservation of biodiversity placed Kew back at the centre of the political stage as one of the focal points of global *ex situ* efforts to preserve the planet's biodiversity.

In an ideal world, all living organisms would be preserved in their natural habitat—a strategy known as *in situ* conservation. But a variety of factors, from the needs of researchers for easy access to the fact that many plants and animals are threatened with extinction in the wild, ▶

have led to the growth of *ex situ* strategies.

Perhaps the clearest evidence of Kew's new role in supporting global conservation efforts is the Millennium Seed Bank currently under construction at its outstation at Wakehurst Place, a 200-hectare estate in West Sussex. When completed later this year, it will be the largest in the world dedicated to conserving the seeds of world plants. Its long-term aim is to collect and conserve 10 per cent of the world's seed-bearing flora (about 24,000 species) mainly from arid drylands by the year 2010.

The bank will make seeds available both for research purposes and for reintroduction into the wild. In Britain, seeds of the starfruit, a small white flower that has almost died out were collected and stored at Wakehurst and samples sent to Kew for DNA fingerprinting. Plants grown successfully from the seeds are now being reintroduced in their natural habitat.

Roger Smith, head of Kew's seed conservation department, says that one of the goals of the seed bank initiative is to achieve Britain's conservation obligations as signatories to the 1992 Convention on Biological Diversity (CBD) "in a way that reduces countries' learning curve involved in setting up their own collections and allows them to have the insurance policy of seed collections under our control."

The CBD requires anyone taking plant samples out of a country to enter a formal agreement specifying the conditions under which this is being done, and in particular the compensation that a country can expect to receive if a commercial application is eventually developed from the plant.

Informed consent

This compensation could, for example, take the form of an agreed share of the royalties resulting from the licensing of a patent based on the plant's genetic properties. A hypothetical case might be that of a plant discovered in the Amazon shown to have powerful anti-cancer properties. Particularly in light of their previous reputation, Kew researchers are keen to be seen to meet CBD requirements.

Agreements are currently being negotiated with countries around the world on the conditions under which seed specimens can be collected and added to the bank. Nations that have already signed up include Mexico, South Africa, Namibia, Mozambique, Venezuela, Morocco, Egypt, Syria and Lebanon. Often this means reaching agreement on creating two parallel collections. One is located in the country concerned. The second, "back-up" collection will be held at Wakehurst Park while remaining accessible on request to the depositing country.

Smith says that the need for a binding agreement on what Kew can do with the seeds that it stores can cause problems, for example when a country lacks any formal mechanism for providing the "prior informed consent" for obtaining data on its plants as required under the CBD.

The same desire to use Kew's knowledge and experience is reflected in a separate initiative to harmonize procedures for access to seed and germplasm collections around the world.

As a result of this initiative, representatives of 14 botanic gardens in 11 countries agreed at a meeting in Beijing last year to adopt a common set of policy guidelines setting out their commitments on acquiring and conserving genetic resources, on the use and supply of such resources, and on the sharing of benefits arising from their use, for example by commercial organizations.

The new priorities that make up Kew's current agenda are very different from those which determined its influence a hundred years ago. "The last thing we want is to be accused of being biopirates," says Smith. "We must not deny that we ever did it. But we must acknowledge that that world has gone." ■

The Royal Botanic and Millennium Seed Bank: www.rbgkew.org.uk
Common Policy Guidelines for Botanic Gardens:

Conservation worldwide

For mammals, birds, reptiles and amphibians, the standard form of ex-situ conservation is in zoological parks. There are currently an estimated 500,000 living creatures in zoos worldwide. Some species such as the Californian condor now only exist in zoos. Others such as Przewalski's horse and the Pere David deer have only survived because they were protected in zoos. They are now being released back into the wild.

The main forms of ex situ plant conservation are botanic gardens (for whole specimens) and germplasm and seed banks. Botanical Gardens International, a non-governmental organization, estimates there are 1,500 botanic gardens worldwide, containing at least 35,000 species, over 15 per cent of the world's total. Some put the estimate as high as 70,000 to 80,000 species.

Most botanic gardens are in the industrialized nations (only 230 are in tropical countries, despite their greater plant diversity). Many seed and germplasm banks are linked directly to botanical collections. Others are owned by multinational corporations, which use them as source material for developing new plant varieties. One survey found that 88 per cent of plant-breeding companies keep their own store of genetic resources.

A third major source of seed and germplasm samples are university departments and the research institutes forming the Consultative Group on International Agricultural Research, funded through the World Bank. ■

A guide to zoos worldwide: http://www.mindspring.com/~zoonet www_virtual_lib/zoos.html
A complete list of arboreta and botanical gardens can be found on: http://www.helsinki.fi/kmus/botgard.html

© J. Netherton/Sunset

The recognition of the fact that the wildlife of the world is irreplaceable but is being rapidly destroyed is necessary if we are to realize in time that areas must be set aside where, in the ultimate interests of mankind as a whole, the spread of man must take second place to the conservation of other species.

Julian Huxley, British biologist, first director-general of UNESCO (1887-1975)

Towards a world conservation ethics

M. S. Swaminathan

The Rio convention marked the first major international step towards the sharing of biodiversity based on the principle of social fairness

It has become commonplace to say that the Convention on Biological Diversity (CBD) adopted during the Rio Summit in June 1992 is an important landmark in integrating the principles of ethics and equity in the use of biodiversity. To stem the increasingly rapid decline of biodiversity, it was necessary to take action, and quickly, without waiting for the scientific community to gather further knowledge. First and foremost, the CBD was an acknowledgment of this urgent need.

It entered into force in December 1993 and so far has been ratified by 177 States—but not by the United States. This agreement, the only one of its kind, sets up a framework for worldwide action aimed at ensuring the conservation, the sustainable use and—a noteworthy development—the fair sharing of biodiversity's benefits. More specifically, the CBD focuses on the definition and the financing of conservation policies, access to genetic resources, North-South technology transfers stemming from the use of those resources, and trade in genetically modified organisms (GMOs). In particular, it acknowledges that poor countries cannot meet their commitments to preserve biodiversity unless the developed nations provide them with access to biotechnologies and the related financing. Biodiversity will unavoidably be depleted through overuse if the current co-existence of unsustainable lifestyles and unacceptable poverty continues, and if the means of subsistence of families putting strains on resources are not strengthened.

The CBD has first and foremost been an effective awareness-raising tool. Political leaders, the media and the general public now know that taking from nature without restraint jeopardizes humanity's security. Many states have changed their national laws to create or strengthen mechanisms to manage biodiversity. The convention has also lent support to the idea that preserving species with their natural habitats and enlisting the local people's support in managing them are vital priorities.

The convention has also prompted over 130 States to adopt a protocol last January 29, 2000 in Montreal (Canada) on biosafety in order to regulate international trade in GMOs. The negotiations led to a stand-off between the European Union and the "Miami Group", consisting of the leading GMO producing countries led by the United States, Argentina and Canada. According to the text eventually adopted, countries may oppose GMO imports deemed hazardous for the environment or health by invoking the principle of precaution—in other words, without necessarily having irrefutable scientific proof that they are dangerous. However, the issue of whether the protocol overrides the rules of the World Trade Organization (the WTO, which so far has not recognized the principle of precaution) remains to be settled. Only a specific dispute brought before the WTO will show whether the protocol has any teeth.

The CBD has certainly enabled progress, but the funding of conservation projects is far from guaranteed. Development aid has been steadily declining since 1992. The Global Environment Facility in charge of, among other things, managing international financing for biodiversity, has received and distributed about $2 billion in 10 years.

Protecting traditional knowledge

Lastly and, most importantly, scant political effort has been focused on guaranteeing a fair share of biodiversity's benefits. Many developing countries continue to denounce what they call "biopiracy" by the governments and companies of the North, which collect their biological resources for commercial purposes. There is an urgent need to take steps that would acknowledge and compensate the inestimable contribution of indigenous rural families to the conservation and improvement of the planet's genetic resources.

That task requires changing intellectual property rules. They are currently being revised in the framework of the Trade-Related Aspects of Intellectual Property (TRIPS) agreement, which regulates biotechnology patents and new varieties of crops. The system in force, based on individually-owned private property, is unsuitable for protecting indigenous people's collective traditional knowledge. The World Intellectual Property Organization (WIPO), which has launched a study on the need to recognize their rights, is likely to help identify alternative solutions. Next, the international community must carry out a crucial task: drafting and adopting a protocol on agrobiodiversity that would protect traditional knowledge and farmers' rights over plant genomes. ■

Holder of the UNESCO-Cousteau chair in Ecotechnology, chairman of the M. S. Swaminathan Research Foundation (Chennai, India), author of I Predict: A Century of Hope-Harmony with Nature and Freedom from Hunger, East West Books Pvt.Ltd, Chennai, 1999.

© Steve McCurry/Magnum/Paris

THE BATTLE FOR AN ETHICAL BUCK

Lucía Iglesias Kuntz

Ethical banks that include socially responsible investments in their bottom line are winning support from people who share their ideals

The jobs and wages of millions of people throughout the world depend indirectly on a bell which at four o'clock every afternoon marks the end of trading on the Dow Jones, the index of leading shares on the New York stock exchange. Almost two billion dollars shift each day from one continent to another at staggering speed. Speculation can make almost every currency tremble, and few trading floors are shielded from an abrupt slump in value. But people's desire to live in a better world is increasingly affecting a commodity that,whether we like it or not, determines our lives: money.

UNESCO Courier journalist

Profit and solidarity have stopped giving each other the cold shoulder and are becoming partners explains Juan Pina, a Spanish journalist who specializes in the social economy. "We are heading towards a set of ethics more attuned to reality, in which profit stops being a kind of necessary evil linked to greed,while the public good stops being the exclusive responsibility of politicians."

Alongside credit cards whose issuers and users contribute a fixed amount of money or a percentage of takings to groups like the Red Cross, Greenpeace or Amnesty International, a number of "ethical banks" have set up shop in Europe, Japan or Canada, and are measuring their profitability more in social terms than by pure financial gain. The basic message which these banks try to spread is that, through no extra effort, the small or large amounts of savings that many people deposit each month in their bank accounts can be used to further their ideals. And that this can be done without abandoning the guarantees offered by traditional banking: solvency, interest, readily available cash and good returns.

The slogans of some of these banks are more than explicit: "The highest interest is that of everybody," announces an advertisement for the Italian Ethical Bank. "Are you content to turn a blind

A fair trade boutique in Belfast: making sure producers get a fair end of the deal.

© Triodos Bank, Netherlands

eye to the way your money is being used, or are you ready to put your principles into practice?" the UK Co-operative Bank asks its potential clients. "The Citizen's Bank's mechanism is value-driven, rather than by economic growth and efficiency," declares a pamphlet from Japan's Citizen's Bank.

Historical roots

The roots of modern ethical investment can be traced to the United States in the 1920s. The Methodist Church, which until then had regarded the stock exchange as a shady gambling den, decided to start investing, but only on condition that it would not put money into the liquor trade or get involved in the betting industry. But social investment did not come into its own until the 1970s.

During the Viet Nam War, groups of citizens decided to boycott the firm that made napalm gas, which had been deployed in the Vietnamese jungle, causing terrible physical deformities in affected communities. From then on, churches, foundations and universities started to ask themselves what their money was being used for. Nowadays, ethical considerations are found in a wide spectrum of bank products: from "ethical investment funds", which look very closely at the companies they buy shares from, excluding those with unacceptable business activities or a proper wage or social policy; to current accounts that offer interest lower than the going market rate, but promise to invest some of their profits in development projects. Likewise, ethical investment institutions come in all shapes and sizes. Some work like normal banks, with branches, cash machines and chequebooks. Others are more like mutual funds or credit co-operatives, such as the French NEF (Nouvelle Economie Fraternelle), which since 1988 has been lending funds solely to teaching, organic farming and health projects.

In keeping with the Internet era, several banks base themselves largely in cyberspace. One of them is Italy's Universal Ethical Bank, which opened its doors for business in Padua just over a year ago, and now has offices in Brescia, Milan, Rome, Florence and Modena. Its president, Fabio Salviato, speaks proudly of having assembled in a short time funds totalling $4.5 million used to finance 250 projects in Italy and abroad. "Our slogan is defence of the poor. In the Third World, of course, but also in Italy, where approximately seven million people live below the poverty line," says Salviato. His bank specializes in social investments made in four areas: the co-operative sphere—fundamental in a country like Italy, which has more than 4,000 co-operatives, the voluntary sector, the environment and international partnerships.

"Above all," Salviato says, "we finance NGOs with micro-credit projects in Albania and Macedonia. In Guatemala, we've helped set up a small community bank in the town of Chajul, which produces coffee to sell to businesses which agree to fair trading. The return we pay on deposit accounts is the same as the Italian rate of inflation, which oscillates between two and 2.5 per cent, while the interest we pay on current accounts is one per cent, somewhat less than the going market rate. But the account's administration costs are also lower than those in conventional banks." This is made possible in large part by the thousands of volunteers from other non-profit organizations who were behind the creation of the Ethical Bank, and which have current accounts and credit needs.

Two thousand registered groups and 10,000 people now have savings in the Ethical Bank. Environmental engineer Loris Rinaldo is one of the bank's customers. "I strongly believe that the economy, much more than politics, is controlling world development," Rinaldo says, "and that banks have a crucial role in deciding which kind of development it will be. I don't accept that the only criteria guiding investment policies should be 'giving money to those who already have money.' I believe the right policy is to give money to those who do good things, even if the return is less. That's why I'm a member of an ethical bank."

Ethical investment, Rinaldo adds, "is a concrete response to criticism of our economic system, which is centred on maximizing profit. This is the start of a revolution, a real revolution based on each one of us, showing that it's possible to build an economy that is also based on values such as the common good, conservation of the environment, peace, respect for marginalized people. In short, an economy centred on people."

Clearly not everybody is as keen as Rinaldo. In an Internet discussion forum on ethics and the economy initiated by Canada's Citizens Bank, there were several comments along the lines of "congratulations for your intelligent marketing campaign, but I'm not interested in banks' ethical opinions. I would prefer them to concentrate on giving the client better service at lower cost."

Reconciling different views

It is also worth asking whether ethical investment, which on one side owes its existence to people's aspiration to live in a better world, might also become part of an image campaign waged by traditional banks desperate to capture this new and socially conscious client base. Guy Hooker, the director of Britain's Ethical Investment Co-operative, believes that "people are choosing ethically sound investments and ethically sound banks because they have become collectively conscious of the power of their money, and because in many cases they get better customer service."

The idea of what is moral is obviously not the same for everyone. Some of us ▶

'I strongly believe that the economy, much more than politics, is controlling world development, and that banks have a crucial role in deciding which kind of development it will be.'

© Citizens Bank of Canada

Each time members of Canada's Citizens Bank use their credit card, the bank donates about 10 cents to Amnesty International or Oxfam.

might think it appalling that a bank finances businesses which deal in arms, though they would not think it so bad if the funds were lent to tobacco companies or to political parties. Likewise, some might prefer to finance literacy programmes rather than save-the-whale campaigns or fair banana trading projects. With these discrepancies in mind, a number of banks, including the Triodos Bank created in the Netherlands in 1980 with affiliates in Belgium and Britain, offer their clients the option of directing their investment to specific areas, such as organic farming or the development of solar energy projects in countries of the South.

Bank spokesman Thomas Steiner explains how his bank tries to reconcile different viewpoints: "Our offices in Belgium, the Netherlands and the United Kingdom do not work like McDonald's, which is exactly the same in every country. Our Belgian partner has a certain Belgian flavour, and emphasizes social development projects; in the United Kingdom we focus more on helping charitable organizations; and in the Netherlands our main concern is the environment."

When the time comes to hand out loans or choose companies that will receive funds, the Dutch bank applies very strict standards. "Like any other bank, we make loans. The criteria we use before deciding whether to grant them are 'positive'; anyone who asks us for money must belong to one of the areas in which we work: nature, the social economy, non-profit organizations, culture and development co-operation. We only lend money to projects that comply with these positive criteria. On the other hand, we have investment funds. We invest the money that our clients entrust us with on the stock exchange through criteria we call 'negative'. We invest only in firms with no links to nuclear energy, arms or tobacco." After 20 years of existence, Triodos has a portfolio of 40,000 savers and 4,000 shareholders.

The goal of transparency

Transparency is a prized goal for ethical banks, including Switzerland's Banque Alternative Suisse (BAS), which in a country where the law protects bank secrecy annually publishes the names of people and businesses that have received its loans as well as details of the sums involved. Citizens Bank, owned by the Vancouver City Savings Credit Union, Canada's largest credit union, goes one step further. As part of its community donations programme, clients are invited to suggest groups which they believe deserve a share of a fund. The suggestions are classified into four groups according to the area in which they fall. Clients are then invited to vote on which groups should receive 50 per cent of the fund, 25 per cent, 15 per cent and 10 per cent, and funds are allocated according to the results of the poll. In 1999, for instance, clients voted to donate $17,700 to the Canadian Catholic Organization for Development and Peace, which fights against poverty and injustice in the world through its partner groups in 50 countries. Second place went to Frontier College, a group of university volunteers active in literacy programmes, which received $9,000. "This procedure involves an externally-facilitated advisory committee comprised of NGO leaders and bank members and staff," explains Gillian Dusting, the bank's public relations director. The Citizens Bank also pledges to reply within 24 hours to all queries about its ethical standards sent by e-mail, while its website hosts a chatline on ethical investment. After three years in business, the Canadian bank has deposits worth over $680 million, while its pre-tax profits in 1998 were almost three million dollars.

Credit and ethical banking

The power of ethical banks in the world economy is still small, though it is growing year by year. According to figures published by EIRIS, a research group on ethical finance, the total volume of ethical funds invested in the United Kingdom rose from $3,300 to $4,100 million between January 1999 and January 2000. The Organisation for Economic Co-operation and Development (OECD), meanwhile, recognizes that although ethical banks "have had some success, they are far from changing the attitudes of conventional banking institutions". In OECD's opinion, the banks' main attraction is that they offer social firms an alternative response to the problems of getting credit.

David Perry, head of the Markkula Centre for Applied Ethics at California's Santa Clara University, concurs that "such banks are sometimes the only means of obtaining loans for people with no credit history and no major assets. And they often combine loans with training in starting and running businesses, which can be extremely helpful to folks with no experience in commerce."

As for the future, Giovanni Acquatti, president of the Milan-based financial co-operative MAG2 and a leading proponent of ethical finance in Italy for the last 20 years, believes it will "depend less on the involvement of public authorities like the World Bank or the European Commission, and more on the strength, courage and resources that we use in personally convincing people that they should behave in a different way. We have a lot of work to do, and we mustn't lose hope. And I never do." ■

Triodos Bank supports the Flemish campaign for the prevention of HIV/Aids. Here, stands set up in Antwerp (Belgium) on World Aids Day, December 1999.

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Citizens Bank of Canada: www.citizensbank.ca
Triodos Bank: www.triodos.nl
Banca Etica Universale: www.bancaetica.com.
Banque Alternative Suisse: www.bas-info.ch

TIMELESS ANGKOR

Fabienne Luco

A fragile thread of continuity connects life around the ancient capital of the kingdom of Cambodia to the distant past

It is a phantasmagoric world. When European travelers discovered Angkor in the 19th century, they were astounded by the grandeur and the mystery of the temples, covered with sculptures of "airy figures stifled and crushed by the forest," in the words of the French writer Guy de Pourtalès. "I have before me," he wrote,"not only an empty capital but 700 years of unrecorded history. And death's most dreaded prodigy: silence." The silence that enveloped Angkor when it was abandoned in the 15th century seemed immutable, but appearances can be deceptive.

A fabulous archaeological site, this great stone skeleton is also a living place, at once the realm of divinities and a city of mortals, where everyday business is steeped in customs from a prestigious past.

© Laurence Leblanc, Paris

Angkor Wat: realm of divinities and city of mortals.

Tales of a nine-headed serpent

Between the 9th and the 14th centuries,Angkor,the capital of the kingdom of Cambodia, grew up between the Kulen hills and Tonle Sap, the Great Lake. At the height of its power, the kingdom included parts of present-day Thailand, Laos and Viet Nam. Over the centuries, kings who practiced religions that came from India, Hinduism and Buddhism, erected monumental stone temples where they honoured their gods. They also built an elaborate hydraulic system comprising huge reservoirs (*baray*) linked to a network of canals, dikes and moats.

Only one contemporary description of Angkor's former splendour has survived. It was written by a member of a Chinese diplomatic mission, Chou Ta-Kuan, who arrived in August, 1296. His vivid account includes anecdotes about the daily life and customs of Angkor's inhabitants. He wrote that every night in a golden tower, the king had to mate with a nine-headed serpent that took on the appearance of a woman. In the palace, bare-breasted women "as white as jade" wore their hair in a bun.At the other end of the spectrum, the commoners were described as "rude, black and very ugly". The nobles were carried about in gold palanquins and dressed in precious fabrics whose patterns were an indication of rank. They lived in houses with lead and tile roofs, while those of "the common people were covered only with thatch". Farmers tilled their fields on the banks of the great lake. In the dry season, when the waters receded from the flooded forest around the lake, the farmers came down from the hills and grew rice.

When the Siamese conquered and plundered Angkor in 1432, the king and his court left the devastated city. The forest overran the ruins. Wooden buildings and writings on latania leaves and scraped hides disappeared, victims of the damp climate and insects.

In the late 19th century, archaeologists ▶

1.The precise functions of these hydraulic engineering works have given rise to considerable debate.As well as providing water for irrigation they reflected the symbolic role of water within an architectural cosmogonic conception in which the temples are an earthly representation of the city of the gods surrounded by the oceans. This irrigation system has for the most part either dried up or been filled in.The only operational section is the western *baray* which has been repaired and today still provides water for some dry-season rice-fields.

French ethnologist who has been working at Angkor (Cambodia) for the last seven years.

began deciphering the inscriptions and scenes depicted in the bas-reliefs carved in the stonework of the temples, which contributed precious information to their understanding of historical timelines and myths, battles and aspects of everyday life, including hunting, fishing, marketing and habitat.

Today, life in nearby villages is much the same as when it was captured in those ancient sculptures. The wooden wheelbarrow that squeaks as it is pushed round a corner is identical to one on a bas-relief. The vendor dozing in front of her stall at the market in Siem Reap, the provincial capital (population 75,000) seven kilometres from Angkor, is resting in the same position as her distant ancestor depicted by a sculptor. On the basin of Srah Srang, located in the heart of the site and bordered by two villages, the fisherman casting his net makes the same gesture as his counterpart of seven centuries ago.

More than an outdoor museum, Angkor is home to religious and rural life revolving around the temples. Inside collapsed sanctuaries and more recently-built Buddhist pagodas, smoke from incense threads its way heavenward before statues of ancient gods and the Buddha. At the threshold of a temple or on a heap of loose stones, the eye comes to rest on cigarettes, rolled betel leaves and candles set down by an anonymous hand. They are offerings to one of the many *neakta*, land spirits who often dwell in Angkor's statues.

A celestial architect

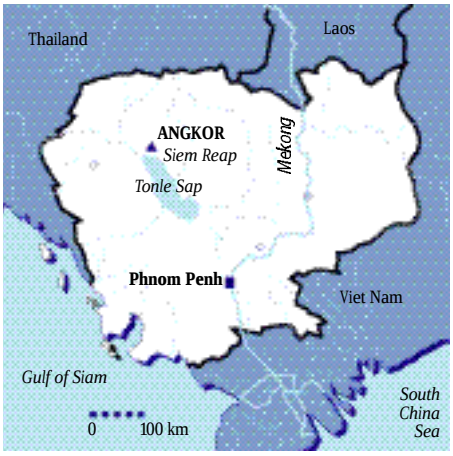
One of these spirits, Ta Pech, lives in a huge termite nest in the southern pavilion of the first wall surrounding Angkor Wat. Ta Pech has a reputation for malevolence. According to a monk, "People say that when an aircraft flies over Angkor,it must make three turns around Ta Pech; otherwise, there is a chance it may crash into the lake. If you give Ta Pech wine and cigarettes, he can also divulge winning lottery numbers."

Other signs of human activity can be read in the present landscape. The grid pattern of nearby rice paddies appears behind the screen of vegetation that cloaks many of the temples. Not always visible from the tourist routes, a score of villages can be made out through groves of sugar palms. They are home to some 22,000 people in a 300 square-kilometre area. Such a high population density on an archaeological site is due as much to the lie of the land as to the temples' economic power of attraction.

The topographical conditions provide an ideal setting for modern dwellings. In the past, people left a profound imprint on the earth by building networks of roads and dikes as part of a water management system. The plain is still shaped by vestiges of these large-scale engineering works. In search of high ground that will escape flooding during the rainy season, Cambodian farmers find the terrain highly suitable for building their homes.

How long has the current population lived in the area and what is the nature of their relationship to Angkor? Unfortunately, there is little information on the size and location of ancient villages. The few recent local writings vanished during the torment of the Khmer Rouge period.And French explorers in the late 19th century considered the temples more important than the people who lived around them—only five or six villages seem to have been recorded.They consist of groups of two to ten houses built around squares in the heart of the forest.

Do the local people consider themselves heirs of the Angkor tradition? Their history is obscure; village memory goes back no further than two or three generations. A few scraps of ancient history have come down to us orally, but it is impossible to establish with certainty whether they are real or imaginary, history or interpretation. The building of the temples is said to have taken place in a mythical period peopled by figures who were half-divine, half-human. The villagers believe that these imposing monuments can only be the work of divinities or of people who came from elsewhere and knew much more about architecture and sculpture than they do.



The legend surrounding the foundation of the temple of Angkor Wat tells the story of Preah Ket Melea, son of the king of heaven and a mortal woman.The divinities said they were disturbed by the smell of Preah Ket Melea and asked his father to send him down to Earth. The king acceded to their request, offering his son the opportunity to have an exact replica erected on Earth of any edifice in heaven with the help of Preah Visnukar, the celestial architect whom villagers still invoke whenever a building is constructed. A modest man, Preah Ket Melea chose the stable. An ox was released onto the plain of Angkor and the place where it lay down was designated as the site for Angkor Wat.

Ebbs and flows of memory

From the orally-transmitted past, villagers above all recall the wars against the Siamese and the Chams, a people from Champa, a vanished kingdom that was located in the centre of present-day Viet Nam, and the accompanying raids and forced displacement of populations. "We Cambodians are accustomed to wars. When you look at the bas-reliefs, you see many battle scenes from the days of Angkor. Since then, those images have constantly repeated themselves," says a farmer. The scenes depict distant times called *boran* ("ancient", in Khmer), or *muoy roy chnam* ("100 years"). Nobody can accurately date them, as this comment by a villager illustrates: "My father says the temples were there when he was born.They must be very old."

By and large, the local people have difficulty imagining that a connection may exist between them and the people who built Angkor. However, in a village north of Angkor Thom there are reports of families who claim to descend from the kings of Angkor. In the early 20th century, they still lived in small, tumbledown wooden hovels at the foot of the royal palace. After the French began restoring the temples, they had to move north. Their current living conditions are the same as their neighbours', but they enjoy a certain recognition."Like the king, they have the power of life or death over the villagers," says one local resident.

Today, Angkor's hydraulic system no longer functions and farmers use rain to water the rice paddies which are still their economic mainstay. Due to the lack of irrigation and the poor quality of the sandy, clay-filled soil, there is only one meagre harvest a year (less than one tonne per hectare). Complementary activities are necessary, such as fishing, market gardening, palm sugar production, sales of handicrafts to tourists and work

© Avery/Ask Images, Paris

Modern times: Angkor's challenge is to strike a balance between preserving its heritage and coping with expanding tourism.

on the temple restoration projects. Technical jobs such as motorcycle, radio and television repair and battery-charging are also emerging.

Angkor, then, creates jobs for the local population. In the late 19th century, after French explorers recognized the temples' historic and artistic value, vegetation was cleared away and stones that had lain half-forgotten in the middle of the forest resurfaced. In 1907 the Angkor Conservation Authority (the French archaeologists' former headquarters and the present sculpture storage site) began restoration work. The few villagers who lived within the temple complex itself were hired as "coolies". By the late 1960s, over 1,000 people were working on the site.

The tourist revival

Before March 1970, when a coup d'état toppled Prince Norodom Sihanouk and war came to Cambodia, the local people had begun crafting small, handmade wooden items, including musical instruments (flutes and violins), toy ox-carts, knives, axes and finely-wrought canes. They started making and selling these objects anew when tourists began streaming back in the early 1990s. In 1999, the estimated number of visitors was put at 350,000, a figure expected to triple by 2005.

The people living on the site seldom enter the temples, even when they are close to home. "We're just farmers. I heard my grandfather say that during the Angkor epoch, folks like me were not allowed within the walls of the capital, Angkor Thom," says one villager. "Only nobles, civil servants and merchants could venture inside. It was the same for the temples: only priests and dignitaries could enter them."

These are something more than reminiscences of a bygone age. Today, religious rituals in the temples are celebrated mainly by masters of ceremony who come to honour the *neakta*. Local people worship these spirits, especially in the villages, by calling upon a medium incarnating the supernatural beings. Most of the tokens of devotion laid in front of the statues in the temple of Angkor Wat have been left by tourists from other parts of Cambodia and Asia on a religious pilgrimage to the site. Local religious activity is concentrated in more recently built Buddhist pagodas. Especially numerous within the walls of Angkor Thom, the pagodas were built near the temples as a way of honouring new divinities in the shadow of the old. Continuity in Angkor can still be felt in the local people's daily lives.

As peace returns and Angkor gears up for major tourism development, the people living there must meet new challenges and strike a delicate balance. Villages along the road-embankments are growing rapidly, and settlement has become dense in some formerly scattered communities. This is a direct outcome of the population growth that followed the Khmer Rouge period (1975-1979). Today, there are five children in the average family, and half of all Cambodians are under the age of sixteen.

Rice paddies are steadily encroaching on the bushy plain. Angkor is protected by royal decrees which limit the expansion of farmland and the cutting of firewood. Traditional secondary activities, such as palm sugar and charcoal production, are now seldom practiced. In Angkor, many issues remain unresolved, including preservation of the temples (especially from plunder), protection of the environment, runaway population growth and the development of tourism.

The loss of traditional values, accelerated by opening up too fast to the outside world, is another cause for concern. The chain of oral transmission broke down during the Khmer Rouge period, and it has proved impossible to revive some ancient traditions. Television, now in every village, is speeding up the loss of cultural identity. It is vital to save Angkor's architectural heritage, but equally important to protect its intangible heritage: the tales, legends and place names that only local people know. ■

ASIA'S ALTERNATIVE TELEVISION

Ethirajan Anbarasan and K J M Varma

An Asian broadcasting network run by young professionals focuses on social and environmental issues

To a first-time visitor it might look like a journalism school or a college campus. Walking along the corridors of Young Asia Television Network's (YATV) headquarters in the Sri Lankan capital, Colombo, one can find youngsters in casual clothes occupying newsrooms and studios. In Asia's vast and expansive electronic media world, YATV may sound like one more television company trying to be successful with entertainment-only programmes.

Not so. The network's young crew is putting together entertainment programmes based on Asian cultural and social values, environment and sustainable development. "YATV is a network for Asian youth. Our motto is 'infotainment and edutainment'. It is a combination of education and information with a lot of entertainment," says Hilmy Ahamed, managing director of YATV network.

Started in 1995 by the Worldview International Foundation (WIF) and some private investors, YATV produces programmes that are broadcast on television channels in countries all over Asia, including Sri Lanka, India, Pakistan, Nepal, Bangladesh, Thailand, Laos, Malaysia and Viet Nam.

An estimated viewership of 250 million people

The Asian satellite television boom in the early 1990s opened up new opportunities for many channels and companies producing programmes for local audiences, triggering a race for maximum viewership. This eventually led to many Asian television networks opting for the shortcut method of making or buying programmes based only on entertainment. According to YATV officials most of these programmes lacked creativity and imagination, and were simply imitations of Western television programmes.

"There was a crying need for an alternative television, especially for youth, which would draw their attention to social and cultural issues instead of bombarding them with Western pop culture," says Ahamed.

The idea for a television network focusing on environment, development and culture was first raised in a conference of South Asian broadcasters in 1989, a proposal which was welcomed by UNESCO. But it was the Rio Earth Summit in 1992 that actually paved the way for setting up an alternative television unit. The Non-Governmental Organizations' (NGO) forum at Rio gave the mandate to the WIF, which has been in the field of development communication in Asia since 1980.

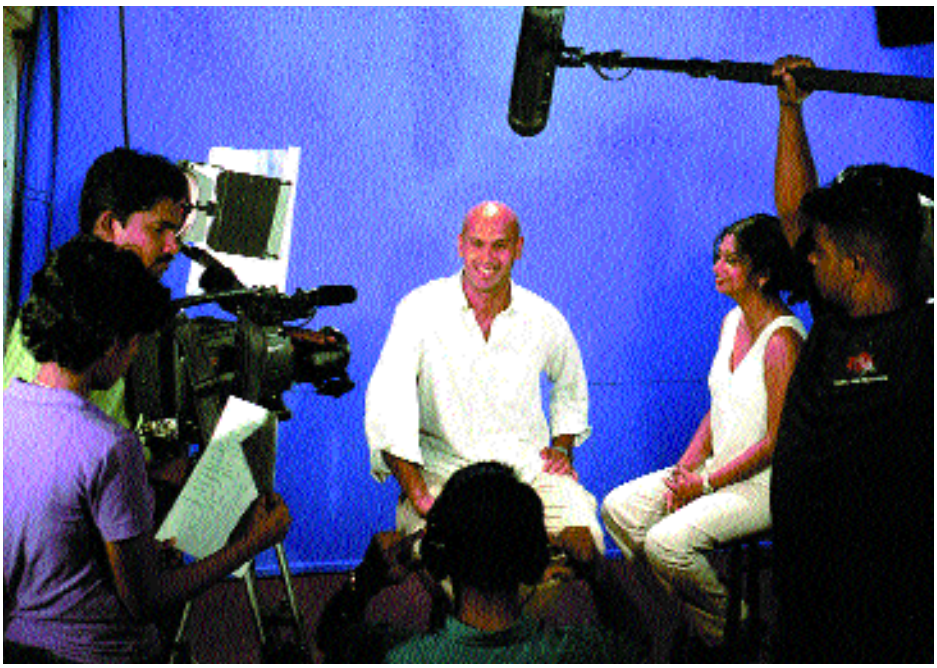
The WIF, funded mostly by Norwegian and Swedish aid agencies, set up the network in Colombo where it has a full-fledged media centre. YATV was launched with an initial investment of about $18 million. It is a business enterprise with 51 per cent owned by the WIF and 49 per cent by private investors, mostly multinational corporations.

For WIF, Asia was the obvious place to launch an alternative network. Half of the region's three billion inhabitants are under 24, hence the tremendous impact of television. In addition, there were no television networks or channels dedicated to programmes dealing with social and environmental issues.

YATV started with one-hour weekly programmes, based mostly on information about developmental issues provided by the United Nations and NGOs. In 1996 the network started producing seven different 30-minute programmes broadcast each day, focusing on a wide range of subjects. Today, on average, about 15 hours of YATV's programmes are shown every week on terrestrial and satellite channels throughout Asia—such as India's Doordarshan Metro (DD2), Pakistan's PTV World, Nepal's NTV, Malaysia's RTM, Bangladesh's Ten Network, Thailand's ITV and Channel 5, and Viet Nam's VTV 2.

Despite this wide geographical spread and with an estimated viewership of about 250 million people, YATV producers admit that they have not yet conquered a mass audience. Without a channel of its own, this will be difficult. Recent surveys estimate

A young crew: recruited from across Asia, the network's journalists and technicians are on average 24 years old.



© Sriyantha Walpola, Colombo

Respectively *UNESCO Courier* journalist and Colombo-based journalist

© Sriyantha Welpola, Colombo

Learning the ropes: over sixty YATV trainees have moved on to secure jobs with Asia's major television networks.

that about 30 million Asians watch YATV's programmes. "This is not a mass appeal programme. We cater to a niche audience wishing to see more meaningful and qualitative programmes than watching Music Television (MTV)," says Ahamed.

But even getting this far has not been a smooth ride. YATV has had to battle with giants like the STAR TV network and well-established television companies from other Asian countries. They soon realized that only by being innovative and different from other players could they gain viewers, especially among youth.

To begin with, YATV recruited youngsters without any experience in television journalism and trained them to make programmes. Today, it manages a crew of about 120 young media professionals drawn from various Asian countries—the average age being 24.

"We asked our young team members what type of programmes they would like to see and how they would go about making them. This helped to develop a style of our own," says Ahamed. Apart from few high-level positions, young people, between 18 and 25 handle editorial planning, research, writing and filming, making YATV a unique television network in the region. In short, these are programmes made by young Asians for young Asians.

YATV programmes are characterized by their fashionable and creative camera work, their animated and articulate presenters and their extensive use of computer graphics, still not very common among many Asian producers. The Pan-Asian background of the professionals is also an asset in making programmes that attract yong people from different countries.

But slick presentation aside, young viewers are attracted by Made-in-Asia quality programmes dealing with sustainable development, women's rights and more importantly their own culture and traditions. "Previously no producer thought of making programme series on Asian folk music, dance and arts," says Parthiban, a 23-year-old producer at YATV. Slowly but surely YATV programmes have gained popularity. Within a year after its inception, YATV gained entry into the top twenty of Sri Lanka's favourite programmes.

Advancing the cause of women

Nature Calls is a popular YATV programme now shown in many Asian countries. It looks at environmental problems from the rainforest of the Amazon to the plains of Tanzanian Serengeti, from the peaks of the Himalayas to the coral reefs of the Maldives. The programme presents stories showing our common heritage and highlights the need for a balance between exploiting and conserving resources.

A recent *Nature Calls* focused on ancient irrigation systems and organic farming techniques practiced in the Asian region for centuries. It also discusses how eco-friendly traditional farming techniques could help to improve environmental conditions in the region. A feature on Eco-warriors profiles leading environmental activists who are involved in the struggle to save our planet.

Another popular programme, *Space to Let*, tackles a wide range of social issues of concern to women, including education, employment, healthcare, sexuality, reproductive rights, abortion, and discriminatory practices like the dowry system, arranged marriages and female circumcision. It doesn't just look at "women's issues" but rises to the challenge of conveying woman's views and takes a firm stand against certain practices upheld in the name of tradition.

The *YA Tribe* aims to celebrate Asia's diversity. A special segment of the programme, *The Gong*, is devoted to promoting traditional Asian musical forms and artists, as well as exploring the fusion between Eastern and Western forms. *View to Tell* presents folk tales and mythological stories passed on from one generation to another, keeping this intangible heritage alive among the young.

"The Asian focus of the programmes appeals to me a great deal because there is so much to learn and relate to from our own region," says Christine, a housewife in Colombo. ▶

© Sriyantha Walpola, Colombo

The network makes extensive use of computer graphics, still a fairly rare practice in Asia.

► In the past three years, young people from Nepal, India, Bangladesh, Pakistan, Malaysia and the Philippines have trained and worked alongside Sri Lankans at the production headquarters in Colombo. After gaining a few years experience at YATV, trainees often move on to other mainstream networks. Today, over 60 of its trainees have landed jobs in almost all the major television networks in Asia.

"At YATV I feel that I am doing something that has the potential to make a difference, to empower, to inform, to show that someone cares," says 22-year-old Robin David, an Indian media professional who produces *YA Café*, a programme on Asian music, cookery and fashion.

To ensure that programmes include content from countries across the region, YATV has production centres in Nepal, India, Bangladesh and Malaysia, along with a network of stringers in Pakistan, Thailand, the Philippines and Singapore. The programmes are mainly produced in English and either dubbed or subtitled in different languages.

In addition, Pakistan Television's satellite services provide an Urdu version of the programme *Nature Calls* to Bangladesh and the Gulf States. Vijay-TV, a satellite television channel in southern India, broadcasts a Tamil version of *Nature Calls*. An Astro Satellite TV cable and satellite services provide Malaysia with Bhasa Malaysia and Tamil versions of the programme *I-Zone*, dealing with youth issues.

YATV is about to make its debut in China. Chinese Educational Television (CETV) has agreed to broadcast YATV's two programmes on *Nature and Culture*. YATV officials say that these programmes will be adapted to Chinese viewers. With the new deal the channel hopes to broaden its audience substantially.

YATV mostly buys airtime from terrestrial and satellite networks preferably at prime time in order to attract the largest possible audience. Income is generated mainly by programme sponsorship and advertising. Some networks buy programmes directly or enter into a cost-sharing or co-production arrangement with YATV.

Recently organizations such as UNICEF, the Asian Development Bank, Save the Children-Norway and WHO have started sponsoring programmes on children's rights, democracy, sustainable development and nature. Operating with an annual budget of $3 million, YATV made modest gains for the first time in 1999 and hopes to turn a greater profit this year.

YATV recently started dealing with sensitive political topics through programmes on Sri Lanka's long-drawn-out ethnic conflict. *Sathi* (Awareness) in Sinhala and *Vilippu* (Awakening) in Tamil are the network's responses to the perceived apathy, insensitivity and resignation of a large number of people to events in the country. Producers put the blame on a lack of awareness about the needs and experiences of those most affected by war.

"It was not easy in the beginning as hard-liners from both sides were not happy," says Sulochana Peiris, a 26-year-old producer in charge of *Sathi*.

Opening up a dialogue

The two programmes, telecast nationally, look at the need for initiatives to be taken by both communities to achieve peace and reconciliation in Sri Lanka. For the first time, Sinhala viewers get the Tamil perspective of the conflict through one programme while the other gives Tamil viewers the Sinhalese side to this 25-year-old saga.

"It has a good response from the young people. This is the reason why we want to continue with it," says Nimal Perera, news director of the Talashine Network Ltd (TNL), a private channel in Sri Lanka.

Now YATV is looking beyond Asian borders. As a first step they want to produce a show called *Planet Asia*, a compilation of its best programmes, aimed at Western countries, to raise awareness among young people of the issues facing their Asian peers. YATV's future plans include entering the European ethnic television market. Throughout Europe there are many ethnic Asian channels trying to cater to immigrant communities.

With their success, do they hope to fight Western culture? "No it was not our aim. We know that it is difficult to fight the likes of MTV culture," says Ahamed. ■

WEBSITE OF THE MONTH

http://www.unesco.org/virtual-library

A selection of UNESCO books are now entirely available online and free of charge. This virtual library is part of the Organization's new efforts to make books available to the widest possible public using the latest developments in communication technology. Though presently limited as to the number of titles, many in this first selection of works are out-of-print. The majority are concerned with world heritage sites, complete with photographs and maps. This experimental project plans to add more titles on a regular basis. Arctic languages or Simon Bolivar, Hué or Gorée, the choice is yours. On your bookmarks! ■

Worldview International Foundation (WIF) is an independent, non-profit organization with headquarters in Sri Lanka. Founded in 1980, it has consultative status with many United Nations agencies. WIF operates a network of Media Centres in Asia and the Middle East.

Useful website: http://www.lanka.net/yatv

OCIMAR VERSOLATO'S HYBRID CREATIONS

Though too pricey for the average consumer, Brazilian couturier Ocimar Versolato interweaves multiculturalism and sensuality to create designs that match women's dreams

© Sebastião Salgado/Amazonas Images

Paris has Japanese, South Korean, Malian and Moroccan designers, but few people from the South have achieved the rank of "couturier".

Fashion design now exists in every country in the world, but I am only the third designer from the South—after Azzedine Alaïa of Tunisia and Oscar de la Renta of the Dominican Republic, for the Balmain fashion house—to have achieved the rank of couturier, recognized by their peers of the Paris haute couture professional trade body. Until now, that distinction was reserved forWestern designers from countries with a more developed fashion tradition. I was lucky enough to start out at a time when haute couture was opening up to new talents and encouraging new fashion houses that were able to express a particular aesthetic sensibility despite their limited financial resources. So I didn't suffer from chauvinistic ostracism, in fact, it was just the opposite. From Italy's Schiaparelli to Spain's Balenciaga, haute couture has always embraced people from different countries. Because Paris is in a class of its own. It is no more French than NewYork is American:it belongs to the world. On the other hand, Parisians are so uptight and demanding that you have to be really talented to express yourself here.

Do you consider fashion a form of artistic expression?

The couturier is not an artist, but a craftsman with his or her own sensibility. No artist is expected to change so fast,creating two collections a year. And then, fashion comes with commercial obligations. My work provides a livelihood for a whole team: I don't have the right to run out of inspiration. So people shouldn't imagine us as egotistical artists bullied around by financial backers. Fashion is an artistic industry resulting from compromise rather than tension. Designers and their financial backers know that they have to move ahead together. ▶

© J. L. Lalouy/Ask Images, Paris

Diaphanous drapings in Rajasthan (India): doesn't every woman invent her own style?

Designers can no longer make their wildest dreams come true and then just forward the bill,like they used to.

If fashion is not an art, then what is it?

Fashion designers and couturiers apprehend the subconscious life of our societies and go on to represent it with their own particular sensibility. There is a crucial need for fashion to maintain this transparent channel to people's sub-conscience, in order to uncover their hidden desires and give expression to them.That's why we don't look at our surroundings the way others do. Our minds are fast as rockets and we look at everything through emotional, impassioned eyes. I admire the speed of videos that give you a maximum amount of information in a minimum amount of time. Now that's a truly contemporary language!

How do you justify haute couture prices?

An evening gown, which is entirely sewn by hand so that all the stitches are invisible, requires hundreds of hours of highly specialized work. Add to that the employer's payroll expenses and overhead, and I have to sell it for around 80,000 French francs ($13,300).

In spite of the high prices, is haute couture a profitable business?

My fashion house, like many others,lives off the patronage of approximately fifty customers. We aren't losing money, but we aren't making much, either. Many houses take advantage of the prestige associated with fashion to sell perfumes and accessories, which are more immediately profitable.I've refused to do that: you cannot exercise a creative activity with nothing but the profit motive in mind. If I want to communicate the image of my creation to customers, I must absolutely not ruin that image by launching, for example, a shampoo with my name on it. Or you have to justify your approach. Mine starts at the top: I began with haute couture, developed luxury ready-to-wear clothes and launched my line of jeans, always sticking as close as possible to my customers' needs

Your dresses follow the outlines of an ideal woman: the Versolato woman. Do your customers look like her?

I'm surprised to see how much my customers resemble each other both because of their age—between 18 and 40—and character. They are self-confident women who

A MODEST START

Ocimar Versolato was born to parents of Italian origin in 1961 near São Paulo, Brazil's industrial capital. Deprived of an income following the death of his father, an industrialist, his mother opened up a sewing workshop patronized by the cream of São Paolo society. Unlike his five brothers and sisters, young Ocimar fell in love with the business.

Since there was not yet a place to study fashion in Brazil, Versolato went to architecture school, but soon dropped out and started a successful business making accessories that he sold to ready-to-wear shops. In 1987 he left for Paris after meeting Marie Rucki, director of the prestigious Berçot fashion design school, where he enthusiastically took classes.

The young Brazilian perfected his training during a four-year stint with the designer Hervé Léger before launching a luxury ready-to-wear line in 1993. Staged with the help of a few friends and a 3,000-franc budget ($500), his first show of evening gowns won him many offers. Versolato joined Lanvin, where he designed women's ready-to-wear for two years, introducing jeans to the venerable house's collections. Funded by Pessoa de Queiroz, a Brazilian trust, Versolato set up a workshop on the Place Vendôme, where he presented his first haute couture collection in 1998. His label–which makes, among other things, ready-to-wear, and lingerie–has changed hands several times and is currently finding new backers. ■

HAUTE COUTURE

In 1858, Charles Worth of Great Britain, Empress Eugénie's couturier, moved to the Rue de la Paix and, towards the end of the nineteenth century, presented his creations on living models. "Haute Couture", which stood apart from hand-made garments by its luxurious nature, quickly became a form of expression practiced by all the great names in fashion history, including Poiret, Chanel and Balenciaga. Industrial production methods based on American Taylorism developed in the 1930s and 1940s, and by the 1950s hand-made garments entered the era of mass production: ready-to-wear was born.

At the same time, haute couture prices continued to climb, partly to factor in expensive labour costs. Meanwhile, its clientele steadily declined. By the 1980s, haute couture was being exhibited in museums, raising it to full-fledged art form status. Based exclusively in Paris and, secondarily, in Italy, where Versace and Valentino have their own 'Alta Moda' lines, haute couture designers present two collections a year including approximately 60 pieces per couturier, which make headlines in newspapers' fashion sections around the world. Although haute couture is in the red today, its prestige allows companies to sell less expensive but more profitable items like ready-to-wear, handbags, fragrances, watches and eyeglasses.

Haute couture sales may not be rising in volume, but overall the fashion market is expanding by leaps and bounds. The most powerful groups are Calvin Klein and Ralph Lauren of the United States, followed by France's LVMH (Dior, Givenchy, Lacroix) and, far behind, Italy's Armani, Gucci and Prada. These companies are still very discreet about their profits. For comparison's sake, French designers and couturiers recorded sales of 20 billion francs ($3.3 billion) in 1997, as opposed to 16 billion ($2.6 billion) for Calvin Klein alone. ■

do not feel inhibited about showing their bodies. By choosing my light clothes, which enhance their character, they feel like they are reaching the perfect balance that defines elegance. These women come in sneakers and jeans. They put on an evening gown. And suddenly their postures, their attitudes and even their faces change. They feel beautiful, they're no longer the same. I enjoy the fact that haute couture enables me to have direct contact with my customers, which would hardly be possible in ready-to-wear, where the only people designers ever meet are buyers.

Too many people cannot afford haute couture...

To offer everybody the pleasure of a purchase, I have created a line of jeans starting at 400 French francs ($67). Today, the heart of dreams—haute couture—is on television when the two annual collections take place. In my view, having access to dreams is more important than possessing the item that nurtures them. When I arrived in Paris, I had a very tight budget. And yet I visited art galleries, examining everything I wanted to buy without paying any attention to the price, but trying to picture what it would look like at home. It's the same with clothes. You can't afford to buy everything you want, but you should at least be given the chance to see what's out there and savour the dream inspired by these fashions.

Even though fashion has become an international industry, do the dresses you design for your customers reflect your origins a little?

They attempt to express the natural seduction which has free rein in Brazil. My fellow citizens are open, smiling and friendly. They want to seduce everybody all the time. My dresses bear the mark of a country where people are not ashamed of their bodies. Whether or not they have perfect looks, Brazilians live almost naked six months a year, wearing just a pair of shorts or small items. I discovered that in Europe, on the other hand, the body had to remain hidden. Its cultural tradition advises against displaying a less-than-perfect chest or wearing a mini-skirt if you don't have pretty knees. The couturier in me is trying to treat these traumas.

Brazil is a mixture of ethnic and religious groups. Does your fashion reflect cultural diversity?

I remember two Arab princesses. The mother, who was rather strict, got upset when she saw that her daughter was interested in a see-through dress. Until I offered to add a bodysuit to give a layer of covering. The cultural diversity expressed by my fashions consists, among other things, of offering sensuality to those who are deprived of it because of their culture. As for the rest, I'm impervious to race, except when I can use it as a source of inspiration. I designed an haute couture collection based on the theme of multicultural melange, dressing Japanese like Africans, Africans like Russians, and these amusing twists went over well. For fashion is a world unto itself, free, without prejudices—and therefore open to all kinds of mixing. As an international form of expression, fashion must integrate all cultures. My team includes Brazilians, Italians, Japanese and Germans, whose skills round each other out.

Do people in Brazil and the rest of South America keep up with your career? ▶

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I haven't worked at becoming a sort of star in South America, but fame is part of my profession. For example, I didn't think anyone had ever heard of me in Buenos Aires. So I was totally surprised when television journalists there got in touch with me. They consider me South American rather than Brazilian, and, as such, a representative of Argentina.

Does Brazil have an innovative, lively fashion scene?

The reality is that too many people there, as elsewhere in the southern countries, make copies. More accurately, copies of copies of copies. But Brazil is a country where anything is possible. Dirt poor provinces exist next to highly developed metropolises such as São Paulo, where luxury can find some expresion. And Brazilians, like any other people, are able to show the world their particular sense of aesthetics. I'm delighted that Brazilian fashion designers have made headway and now have the courage to show themselves. But they have neither the know-how nor the standards to be internationally successful. They are naive to the point of designing a whole collection with a flat pattern, a simple sewing machine and an overcast machine[1]. Their clothes don't have any volume, roundness or sophistication. Nobody ever taught them how to make a well-tailored jacket.

How can they get out of this dead end?

Brazilians are curious by nature, and they want to learn. I'd like to help them by encouraging a transfer of techniques. In France, labour in the fashion industry is in short supply, highly specialized and expensive, while tens of millions of people are unemployed and looking for work in Brazil. By training some of them in France, we'd also find a long-term way of improving technical skills and raising standards back in Brazil which could make quality shoes and clothes for all the designers in the world.

Are you advocating globalization?

It's already here. Today, you can design a garment here, assemble it there and embroider it somewhere else. So you're better off making the most of what everyone's best at. After the war, smart people in overpopulated India opened small embroidery factories. Today, almost all the embroidery sold around the world comes from India, and the quality can be as good as it is in Paris.

Have other developing countries specialized in other techniques?

Right now, everything is incredibly centralized in Europe—or in Japan, a country that can be considered Western. But China has developed techniques for silk, of which it is the world's leading producer. One day it will probably have the same state-of-the-art technology as Europe. And when that day comes, the other countries will tremble.

Does Brazil have any women fashion designers?

Most of the neighbourhood designers are men, but Brazilian women have never come up against any obstacles to enter the fashion industry. Each one is a designer in her own right. Gifted with an innate sense of grooming, they know how to dress for any occasion without falling into stereotypes or ridiculous clichés.

Do women prefer being dressed by men?

Male designers give themselves the freedom to be more daring than their female counterparts, simply because they don't have to wear what they create. Their aesthetic sense blossoms without restraint and their customers, who don't hesitate putting on eight-centimeter heels to look beautiful, prefer aesthetics to comfort.

What's your state of mind when you design your collections?

Couturiers are wrongly described as heartless and inaccessible. On the contrary, like all creative individuals, they are very sensitive and try to defend their fragility. If they want to sell dreams, they must find an image of the world that expresses happiness. So it really doesn't matter whether they keep their feet on the ground. Clothing designed by a couturier is different from ordinary ready-to-wear because of the feelings it conveys. During a fashion show, a dress has just 30 seconds to express a whole universe.

Have you used your fame to serve useful causes?

I've staged a fashion show that people had to pay to see, with the $20,000 in proceeds going towards the construction of a building for children with cancer. Right now, I'm working with the photographer Sebastião Salgado on a reforestation project. The funding will come from a show I'm helping to put on. ■

Interview by Jacques Brunel, journalist, contributor to Le Monde and Vogue, and René Lefort, director of the UNESCO Courier.

1. An overcaster is a machine used to stitch the edges of two pieces of fabric together.

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